

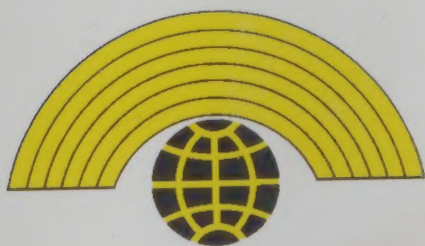
# Learning to Become a Physician at Sherbrooke

A Full Switch to a Student-Centered MD Program

Jacques E. Des Marchais  
and Collaborators

**Editors**

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## **A Full Switch to a Student-Centered MD Program**

**Jacques E. Des Marchais  
and collaborators**

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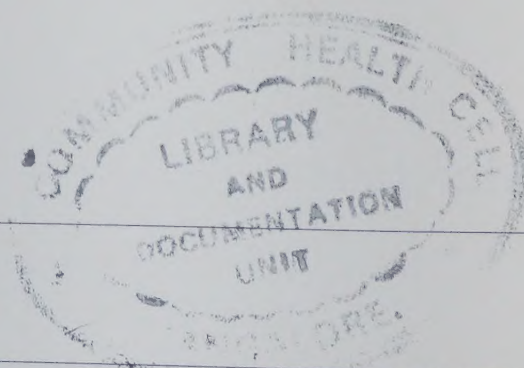
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*To Gilles Pigeon,*  
*Dean from 1971 to 1979 and from 1983 to 1987,*  
*for his foresight and astuteness*  
*in recognizing the basic issues*  
*and for his courage and determination*  
*in undertaking the change.*  
*and to Bertrand Dumais,*  
*an indestructible colleague with whom*  
*I shared every instant of this once-in-a-lifetime endeavor.*

*To Denyse Lemay,*  
*my best educational consultant and an untiring partner,*  
*for her sagacious advice*  
*and her unwavering faith in the Sherbrooke project.*

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## CONTENTS

<b>Preface of the English Edition</b>	7
<b>Preface of the French Edition</b>	9
<b>Acknowledgements</b>	11
<b>Introduction</b>	13

### **PART I                      The Reform Initiative**

1.     A Planned Program Change	19
<i>Jacques E. Des Marchais</i>	

### **PART II                      Contents of the Reform**

2.     The Preclinical Training Program: Orientations, Activities, and Administration	43
<i>Bertrand Dumais, Jean-Pierre Bernier and Jacques E. Des Marchais</i>	
3.     Problem-Based Learning: The Vehicle for the Educational Reform	79
<i>Bertrand Dumais and Jacques E. Des Marchais</i>	
4.     Teaching-Learning Clinical Skills	113
<i>Guy Lacombe and Jacques E. Des Marchais</i>	
5.     Student-Learning Assessment	143
<i>Jacques E. Des Marchais, Robert Black and Nu Viet Vu</i>	
6.     Integrating the Learning of Medical Humanism into the Curriculum	179
<i>Daniel J. Côté and Jacques E. Des Marchais</i>	
7.     Reforming the Clerkship: The Challenge of Clinical Learning	209
<i>Bernard Charlin, Martine Chamberland, and Jacques E. Des Marchais</i>	

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## **PART III                      The Conditions for Reform**

- |     |  |     |
|-----|--|-----|
| 8.  | Educating Teachers for a Student-Centered Pedagogy<br><i>Paul Grand'Maison and Jacques E. Des Marchais</i>   | 233 |
| 9.  | Training Teachers for the Tutor Role<br><i>Monique Chaput and Jacques E. Des Marchais</i>                    | 251 |
| 10. | Payment of Teaching Staff and Funding for the New Program<br><i>Jacques E. Des Marchais and Henry Haddad</i> | 287 |

## **PART IV                      Evaluating the Reform**

- |   |  |     |
|---|--|-----|
| 11.   | The Program Evaluation System<br><i>Jacques E. Des Marchais</i>  | 311 |
| 12.   | The New Program: The Student Perspective<br><i>Michael Beaudoin with the collaboration of Nathalie Cauchon,<br/>Béatrice Des Marchais, David Fortin, François Belzile and<br/>Caroline Giguère</i> | 350 |
| 13.   | Continuing Problems in a New Socioeducational Culture<br><i>Jean-Pierre Bernier and Jacques E. Des Marchais</i>  | 367 |
| Epilogue: Letter to Charles<br><i>Jacques E. Des Marchais</i> |  | 390 |
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## Preface of the English Edition

Henk G. Schmidt<sup>1</sup>

Only once or twice in a professional life one meets these extraordinary people: Colleagues who think of doing things that others may not even dream of, and then go about and simply *do* them. To me, such a meeting with colleagues who turned out to be out of the ordinary, happened fifteen years ago. I still remember exactly where I was. There was a Network conference in Ismailia, Egypt. I was about to leave the pool area when I was approached by two men. They introduced themselves as Jacques E. Des Marchais, vice-dean for education, and Bertrand Dumais, senior consultant in cardiology, of the medical school of the Université de Sherbrooke. They explained to me that their school was about to embark on a large scale process of renewal of its curriculum.

There were three reasons for embarking upon change. The dean, Gilles Pigeon, argued that human values should be more emphasized in the medical curriculum. Otherwise doctors would take the risk of becoming medical technologists without any real interest in the human condition and in human suffering. Second, the Sherbrooke medical curriculum was considered not entirely up-to-date and needed some fresh air. And third, in the local Quebec situation with its four medical schools serving a population of seven million people, there was a definite possibility that one of the schools would eventually have to close. Sherbrooke was determined not to be that school, and saw the necessity to offer its students a real alternative to what the other schools were offering. That alternative would be, explained the two gentlemen, a community-oriented and problem-based curriculum. And if I was willing to lend some assistance in reaching that goal.

I was sceptical. I had seen many attempts at innovation of this kind fail. In fact, I did, at that time, not know of a single success in turning around an existing medical school. The attempts that I knew of all failed in an early stage, because of lack of support, and even active resistance, of staff or leadership, or both. In addition, there was, in my view, often a general lack of understanding among innovators of what is needed in terms of knowledge and skills to undertake such endeavour. For instance, the skill of translating faculty objectives into problems for students is acquired only through extensive experience. The same applies to the ability to develop strategies for community-based teaching, with all its dependencies on local needs and constraints. This experience was often not available among prospective innovators.

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<sup>1</sup> Between 1987 en 1995, Dr. Henk Schmidt was Associate-Secretary General of The Network: Community Partnerships for Health through Innovative Education, Service, and Research, a WHO-supported group of schools dedicated to innovation in health professions education. In addition, he was Dean of the Faculty of Health Sciences, Maastricht University. He is a Professor of Psychology, currently at the Erasmus University, Rotterdam, the Netherlands.

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My objections were taken seriously, but it became soon clear that they did not deter both men. Later, when I became actively involved in their innovation as a consultant and trainer, it became clear to me why they were so confident that they would not fail. Both of them turned out to have long careers in innovation in medical education. Jacques Des Marchais for instance had been assistant to the dean for education at the Université de Montréal for quite a number of years and had established there a department of medical education. Both men clearly were seasoned and possessed the requisite skills to do the job.

I visited Sherbrooke for the first time in the summer of 1986 and have returned there many times since. Therefore I was in a position to observe the innovation process quite closely. I asked myself often why Sherbrooke was so successful, why it succeeded where others had failed. The answer is that at Sherbrooke a type of collaborative leadership was practised that seemed to be part of French-Canadian culture, and that I had never seen before. Des Marchais was clearly the man in charge, but he was continuously busy involving a large group of colleagues in all decisions, big or small. The result of this strategy - that did not come to him naturally, because he is an orthopaedic surgeon used to take decisions on his own - was that, unlike in other institutions, the innovation was the shared responsibility of a majority of the staff rather than of a small group of the initiated. This is indeed the predominant memory that I have of my own Sherbrooke years: the endless group-decision-making exercises that, in the end, made the difference.

The two men whom I met at that pool in sunny Egypt, Jacques E. Des Marchais and Bertrand Dumais, these men fulfilled their dream. Where others failed, they succeeded, and they succeeded gloriously. The results of their dreaming and of its aftermath are in this book. It has become a monument of their efforts an a tribute to the men and women of the Sherbrooke medical school who were willing to put their reservations aside, to trust their colleagues, to learn the new skills, and to become genuinely involved in the learning of their students.

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## Preface of the French Edition

Charles Boelen<sup>1</sup>

What a wonderful story by our friends at the University of Sherbrooke about the flourishing of their faculty of medicine! Told in a straightforward manner from start to finish, it's the whole, unadulterated story, with all its twists and turns, demonstrating their character, courage, and conviction.

It all began quite simply ten years ago. In taking stock of their approach to medical education, the Sherbrooke faculty recognized the need for change and growth. In a twinkling, they were placidly but eagerly and steadfastly headed down the road to change ... on an institutional level.

Being a physician is such a great calling ... but what a challenge learning to become one is! Our friends at Sherbrooke were able to clearly assess the scope and challenge of the undertaking. The key was to mobilize and orchestrate the university's considerable potential to produce one of the main players—possibly the key player—in the health-care system. They had to have a crystal-clear picture of all that the word “physician” implies as well as of the role of the physician in the health-care system before attempting to implement a major overhaul of the educational program.

The Sherbrooke program didn't just happen; it was carefully thought-out. And, in the end, they didn't take the more traveled road, opting instead for an innovative approach to teaching. They chose their direction and plotted a course. Their objective was to train a “good doctor,” meaning a life-long learner; someone attuned to the needs of the community, a humanistic. Despite the difficulties encountered along the way, they stayed on course.

They clearly set down the changes needed to achieve their collective goal, so that all the players in this undertaking - students, teachers, health-care providers, and managers - would have a clear understanding of the implications.

Our colleagues in Sherbrooke explained and launched the reform, sustained the effort, encouraged the early pioneers, solicited the undecided, and brought in new converts throughout the entire process, right up until the new structure took shape. The new structure was intended to be humanistic—and it was. But the enthusiasm of the pioneers didn't keep them from using rigorous methods in planning and scheduling reform implementation and in critically assessing its outcomes.

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<sup>1</sup> Dr. Charles Boelen is Chief Medical Officer with the World Health Organization, Geneva, Switzerland.

The reader, as a potential reformer, will learn how to convince his or her partners more easily of the merits of the cause, avoid the resistance of some, contain the reticence of others, reassure worriers, and rekindle the initial enthusiasm when it begins to wane. The Sherbrooke reformers take a critical look at their accomplishments, but they do it with humor. They freely acknowledge that their determination occasionally pushed them into contradictory situations. Consequently, they ended up trying to examine each of everyone's skills in detail, at the risk of putting what was supposed to be an overall approach - such as the student-patient relationship - under the microscope.

Nevertheless, they are aware of the shortcomings and acknowledge that much remains to be done, either by themselves or those who come after them. When they venture to give advice, they never give into the arrogance typical of someone who believes to be speaking authoritatively based on accumulated experience. In fact, they do so with a simplicity that demonstrates a willingness to learn in return for telling their story. They know that improvements to health care and the well-being of their fellow citizens do not depend solely on them and that their efforts, combined with other partners active in organizing health care, are societal levers.

What better encouragement than to read experiences told with enthusiasm?

Such as Sherbrooke's story!

---

## Acknowledgements

Dozens of other colleagues could have taken part in the writing of this book. They include initiators of change, stakeholders, internal agents, and those who adopted the change early on. We are grateful to many, especially those mentioned below.

Dr. Gilles Pigeon, dean of the Faculty of Medicine from 1983 to 1987, pulled together conditions favorable to a major educational change that he guided like a master magician. Dr. Paul Montambault served as the director of the MD program, resource person, designer, and head of the medical biology unit. Dr. André Plante, internist and constant companion throughout every phase, headed up the Validation Committee for dealing with problems in the preliminary version, designed the third-year integration unit, and chaired the Program Committee from 1990 to 1993. Dr. Réjean Hébert, head of the growth-development-aging unit, was the first to use a systematic process for defining a unit's concept tree. He also headed up a validation study on the tutor assessment grid. Dr. Denis Bergeron, radiologist and participant in the neurological sciences unit, was a valuable force behind the tutor training program. Dr. Jacques Allard and the late Dr. Théodore Tahan set up a PBL session on community health during the second year. Dr. Raymond Pageau wrote articles in the Faculty's newsletter promoting the adoption of the new program during the first year of its implementation. Dr. Patrick Loisel, orthopedist, served as coordinator of the preclinical phase from 1988 to 1990.

And how could I not mention my indestructible colleague, Dr. Bertrand Dumais, who, from 1985 to 1992, threw heart and soul into the success of the reform. «It just *has* to work, Jacques,» he would say to me when we would share our concerns. Without him and his ability to enlist supporters, things may have turned out differently. My thanks to him for revising every chapter in this book.

I am also grateful to Dr. Michel A. Bureau, dean from 1988 to 1995, who inherited the new program - barely into its third month of existence - when he came onboard in January 1988. He soon made it clear to the holdouts that the change could only benefit the University of Sherbrooke and our Faculty. He was instrumental in the program's growth and made sure that the necessary resources were available, including the remodeling of three amphitheaters into meeting rooms for small groups in 1991-1992 at a cost of \$2 million.

I also want to express my appreciation to all of our fellow teachers who believed in us from the outset; those who joined in the second round; those who had the openness to absorb new ideas; and those whose contributions enabled the Faculty of Medicine of the University of Sherbrooke to take a great leap forward in implementing student-centered teaching.

Special thanks are due to the students of the Class of 1991 (1987-1991) cohort, the adventurous souls who dared to enroll in this new program: David Barbeau, Steven

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Bartlett, Charles Beaurivage, Sylvie Bélanger, Pierre Bélisle Jr., Sylvie Béliveau, Colette Bellavance, François Bénard, Bruno Bernardin, Natasha Bird, Martine Bissonnette, Manon Blackburn, Annick Brady, André Carpentier, Maryse Cayouette, Chantal Chiasson, Geneviève Clermont, Julie Cloutier, Bernard Contré, Jean-François Côté, Catherine Demers, Luc Deneault, Pascale Desautels, Sonia De Serres, Sylvie Dragon, Stéphane Dubuc, Nancy Duhaime, Éric Dupras, David Fortin, Chantal Fréchette, Patrick Fredette, Jean-Guy Gagnon, Sophie Galarneau, Pascale Garnier, Pascale Gaudet, Isabelle Germain, Anick Giguère, Caroline Godbout, Brigitte Grandmont, Caroline Gravel, Charles Guité, Patrick Houle, Diane Huppé, Julie Hurteau, Diane Jolin, Chantal Joron, François Joubarne, Marie Jutras, Sophie Laberge, Carole Laforest, Doan Trang Lam Tu, France Larivière, Line Lavoie, Jean Leblanc, Marc-André Lemieux, Daniel Lévesque, Francis Lévesque, Sylvie Lévesque, Patrick Liang, Chemir Mamode, France Marchand, Pascale Maurice, Hans McLelland, Danielle Ménard, Sophie Michaud, Nathalie Monarque, Mario Morency, Roger Mortimer, Bich Ngoc Nguyen, Frédéric Ouellet, Paul Ouellette Jr, Jacinthe Paradis, Sylvie Parent, Bonavent Pek, Monic Pichette, Céline Pinsonneault, Johanne Pouliot, Nathalie Provost, Josée Quesnel, Stéphane Ricard, Isabelle Roby, Martin Rouillard, Frédérick Savaria, Édith St-Jean, Nathalie Saint-Louis, Annie St-Martin, Stéphane Tremblay, Nancy Vasil, Marie-Christine Veilleux, Christian Viens, Minh Ha Vo, and Catherine Znojkwicz.

Lastly, I would like to thank Hélène Grosjean and Sylvie Blanchet who, from 1989 to 1996, transcribed successive versions of the various chapters so many times that they thought there would be no end.

And now, on with the story!

## Introduction

Jacques E. Des Marchais

Sunday, September 29, 1985. Dean Gilles Pigeon shook my hand enthusiastically. I had just accepted the position of vice-dean education at the Faculty of Medicine at the University of Sherbrooke. The job came a specific task: implement the reform of the MD program by September 1987, just two years later.

At that point, the project was not very far along. In fact, planning had barely gotten past deciding on program thrust: it had to be student-centered and educate rather than train. Could a new program really be implemented in less than two years? Sometimes pioneers set seemingly unrealistic goals for themselves!

Over the five months following my appointment, I worked to define the prerequisites for change in the faculty. Some were evident: a core of enthusiastic faculty members who were ready to change the program; an innovative environment; an administration determined to restructure the MD program; and an adequate number of small rooms to implement the Problem-based Learning approach. The University of Sherbrooke was offering me a unique opportunity for professional development. I accepted the challenge with all the uncertainty and excitement that accompany a great adventure.

September 1987. Class picture of the 100 first-year students. The new program was underway and already attracting excellent candidates. We promised them a high-quality program; they were counting on us to deliver it. Planning for the first year had barely been completed. The tension in the faculty lounge was almost palpable. The faculty had reached the juncture marking the end of the project to restructure the MD program announced by dean Pigeon in January 1984. The students enthusiastically embraced the program. And we would need the cohort of the Class of 1991 -our test subjects in a way- to complete implementation of the new program.

January 1990. The students in the first cohort started their clerkships. Implementation of the first part of the preclinical phase had been completed. Just as this first dream was beginning to come true, another began to take shape: sharing our experience with the international community, an undertaking requiring the cooperation of the entire faculty.

October 1991. Eighty-six students from the first cohort (1987-91) received their MD degrees after passing Canadian and Quebec certification exams. The first "alumni" of our new program embarked upon their clinical residencies.

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## A Faculty-Wide Project

Although seminars for visitors were held as early as the second year of the program, they were designed as tools for external formative evaluation. People repeatedly expressed that we were "surprisingly open about discussing implementation problems". What started as a restructuring of the MD curriculum turned into a major teaching change that swept our Faculty of Medicine along into social action that gave rise to a new socioeducational culture.

In the mid fifties, the School of Medicine at Case Western Reserve University shifted from a traditional curriculum to a program based on an organ-and-system approach to the human body. In the early nineties, the Faculty of Medicine at the University of Sherbrooke became the second of 1400 medical schools worldwide to completely restructure its curriculum. Sherbrooke, however, opted for problem-based learning. The importance of the shift did not really lie with the development of new methods, but rather in implementing a major modification to the medical education system that would be practicable, feasible, and even lasting.

From 1986 to 1989, "innovation fever" swept through the halls of the Faculty. These were three decisive years, especially for faculty members, who had to trade in the lecture podium for the tutor's chair. Problem-based learning (PBL) became and remains the vehicle for restructuring our teaching approach.

The PBL method (Chapter 3) shatters the monolithic rigidity of the curriculum, its teaching methods, and student assessment. The change in teaching method, which was demanding on the teachers, was driven by a change in philosophical outlook: centering the MD program on students, focusing on community needs, and promoting the practice of patient-centered medicine (Chapter 2). In order for the program to work, the faculty had to buy into an educational philosophy compatible with the proposed methods. Faculty PBL preparation -a prerequisite of change- and tutor training were key to program implementation (Chapters 8 and 9). The new teaching method, the new role of the teacher, new means for evaluating students, and the transformation of course contents into "problems" -all required by PBL- challenged the traditional approach on every level. That was the point at which the Faculty of Medicine had really caught the innovation fever!

## A New Program

The impact of adopting the PBL approach led us to change every other component in the program. The teaching of clinical skills was completely revised to include the mastery of skills specific to each unit and the acquisition of skills related to physician-patient relationship from a humanistic perspective (Chapter 4). Activities were developed to

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promote the adoption of humanistic behaviors (Chapter 6).

As any teacher knows, evaluation methods and techniques are just as critical in student training as teaching methods. Chapter 5 discusses learning evaluation and examines how adopting the PBL approach has affected learning.

## A Collective Project

In 1986-87, opponents of the reform claimed that its implementation would bankrupt the *Société des médecins de l'Université de Sherbrooke*<sup>1</sup> and lead to a significant reduction in basic research. They also feared that the new MD program would drain resources to the point that it would detrimentally affect graduate specialty training. Using the university academic reward system during program implementation enabled us to measure the costs and institutional impacts of the reform (Chapters 10, 11, 12, and 13). The *Société des médecins* continued to grow financially. Research investments increased by 30% and residency programs continued to grow. And the teaching reform would contribute to our Faculty's development in other ways.

"The team is the leader", noted an eminent professor/evaluator during the joint visit of the Liaison Committee on Medical Education and the Committee on Accreditation of Canadian Medical Schools in February 1989. "Can this kind of reform be a grassroots initiative or does it have to come from the administration?" A look at the list of contributors to this book provides part of the answer.

- Bertrand Dumais (62<sup>2</sup>), professor of cardiology in the Department of Medicine and one of the pillars of the Faculty. He resigned as director of the Continuing Education Center to head up the MD program. His leadership and influence led him to get involved in all workshops: teaching, problem building, tutor training, and so on. He has his finger on the pulse of the Faculty and is the soul of the MD program.
- Guy Lacombe (36), professor of internal medicine and geriatrics, earned the nickname "Mr. Clinical Skills". Nearly single-handedly, he devised, planned, and implemented the entire clinical skills program, including the OSCE (objective structured clinical examination). A natural-born educator, he remains a staunch member of the core of internal agents of reform.

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<sup>1</sup> The *Société des médecins de l'Université de Sherbrooke* is an association of the full-time clinical professors in the Faculty. All of their professional earnings are paid to the association, which then shares out the fees and profits (Chapter 10).

<sup>2</sup> Age as of June 1, 1995.

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- Bernard Charlin (45) is an otorhinolaryngologist. His training as a facilitator for the basic teaching development program saw him named coordinator of the clerkship. Because of his interest in the systematic planning of learning, Charlin took up the challenge of carrying the PBL approach used in the preclinical phase into clerkship rotations (Chapter 7).
  - Martine Chamberland (33), a graduate of Sherbrooke's Faculty of Medicine, began her teaching career in the Department of Internal Medicine after earning a master's degree in medical education at the University of Southern California. She was a natural choice for developing a method for teaching the cognitive contents of the residency program. She developed the theoretical basis underlying the sessions on clinical reasoning.
  - Paul Grand'Maison (44), Director of the Department of Family Medicine, had been heading up the Faculty Development Office for five years when planning for the reform started. He was already a member of the committees that, from 1983 to 1985, were laying the philosophical groundwork for the new program. Grand'Maison, an internal agent of change, brought natural leadership to the undertaking; his involvement was seen as tacit approval of the teaching approach under the reform.
  - Henry Haddad (56), professor of gastroenterology, served for eleven years as vice-dean of Faculty and Student Affairs and has remained one of the Faculty's mainstays. His insightful comments at strategic moments during the meetings of decision-making committees facilitated reform implementation. Haddad has an interest in administrative issues and worked on presenting the remuneration system (Chapter 10).
  - Daniel J. Côté (38) is an anesthetist. After a stint as head of the graduate training program in anesthesia, he showed an interest in medical education. He was assigned a variety of tasks relating to program implementation: clinical immersion rotation, basic teaching development program, teaching of clinical skills, and evaluation of the residency program. He has a remarkable way of blending cognitive questioning with consideration for the individual. Côté was the main author of Chapter 6, which deals with medical humanism.
  - Monique Chaput (52), an adult education specialist assigned to the Faculty on a part-time basis, developed the tutor training program. Her involvement was synonymous with the concept of educational coherency, the student-centered program, and formative evaluation. Chaput passed on small-group facilitating skills to many of us.
  - Nu Viet Vu (46) taught medical education in the Department of Medical Education at the Southern Illinois School of Medicine in Springfield, Illinois. In 1986, she became consultant in evaluating student learning. Our second visiting professor in medical education, she laid the groundwork for Chapter 5 on student evaluation.
-

- Jean-Pierre Bernier (46), since named coordinator of the preclinical phase, is a neurologist by training and a major Faculty figure. When he came on-board in 1990, Bernier quickly grasped the issues involved in implementing the new program. He proved to be a valuable asset when the time came for the first team to hand off the baton.
- Robert Black (49), psychometrist, is the Faculty's statistics and testing specialist. In the pre-reform era, he worked alone in his office, carrying out his analyses. Once the reform got underway, he proved to be a valuable member of the MD program team and took part in its research projects.
- Michel Beaudoin, a student from the first cohort, headed up a group of students comprised of Nathalie Cauchon, Béatrice Des Marchais, David Fortin, François Belzile, and Caroline Giguère, who conducted a "consumer" opinion survey among their classmates.
- Jacques E. Des Marchais (55), orthopedic surgeon, received training in medical education in 1974 at Michigan State University. In 1986, dean Pigeon appointed him vice-dean education and gave him the task of overseeing the reform of the MD program.

## About this Book

The main players in the reform of the MD program at the Faculty of Medicine of the University of Sherbrooke contributed to this book. Although their perception is completely subjective, the process is transparent. Each chapter has been reviewed by four or five teachers who were closely involved in the reform. In addition, some chapters were reviewed by colleagues from other universities.

Our ultimate goal is to be informative and analytical in presenting what is essentially a case history. Our solutions may not apply to other situations since there are so many variables that can impact on the sociopolitical context of training environments. Nevertheless, the basic principles remain the same since our story recounts the implementation of a somewhat radical, comprehensive, and continuous solution to problems facing medical education. The reader is therefore invited to use this book as a source of information and thoughtful reflection.

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## PART ONE: THE REFORM INITIATIVE

### A Planned Program Change

Jacques E. Des Marchais

*Evolution is often  
revolution without the «r.»  
- Albert Brie*

#### Introduction

In May 1985, dean Gilles Pigeon asked me to head up the reform of the MD program. One thing was clear to me: insofar as possible, reform had to be carried out according to the rules governing planned change. Specialists claim that it can be done (Bennis et al., 1985; Havelock, 1973) my own experience has revealed to me a number of principles of change and supports this view.

In fact, in 1966, I had the opportunity to take part in the restructuring of the MD program in a young faculty of medicine in Rwanda (Africa). The undertaking succeeded because the university and the three governments involved had an interest in its success. In 1974, I helped plan an integrated curriculum model for a residency program (Des Marchais, 1981). Implementation ground to a halt, which taught me an important lesson: the success of changes proposed by the rank and file hinges on administration acceptance and support.

In 1976, I took part in implementing a clinical immersion rotation for first-year medical students (Des Marchais, 1982). Designed according to open-ended pedagogy, this rotation challenged certain teachings in the behavioral sciences, which delayed its adoption. I learned that there is little room for educational innovation in a traditional faculty. Any attempt at change is met with resistance, which can sometimes be quite strong. In 1981, I set up a medical-education research unit, which was an innovation where I was working at the time. Five years later, the unit was still struggling to fit in (Des Marchais et al., 1990). This taught me that implementing a new unit pushes back the boundaries of existing structures, which must make room for the new one (Levine, 1980).

Any process for change, therefore, is complex and can succeed only if conditions are conducive. Change is a three-phase process, whether applied to an individual, social system, or curriculum. It begins with a thawing phase, in which the bonds in the existing system are modified. This is followed by a period of instability, that gives way to the third phase, or recrystallization, which produces a new, stable structure (Collerette & Delisle, 1984).

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Based on Levine's model (Levine, 1980) the four steps in the selected process are identifying a need, selecting a solution, implementing the solution, and permanently adopting the solution within the social system. These steps are readily evident in everyday life, such as in deciding to buy a new house or renovate an existing home. The analogy will serve to illustrate the steps in a planned process for program change.

Internal program evaluation was instituted at the outset of implementation. It consisted in retreats; annual assessments; meetings with students and reports; visitor workshops; tutor training and problem building; and visits by outside evaluators, including a joint site visit by the Committee on Accreditation of Canadian Medical Schools and the Liaison Committee on Medical Education. All of these activities provided opportunities to identify and clarify the steps that had been implemented and to develop, modify, and plan steps yet to be carried out. The Program Coordination Committee served as the process crucible.

From 1986 to 1989, every three months I recorded the events related to the implementation in a logbook. These reports, annotated by Dumais, highlight the strategic features of our experience.

These planning exercises predate my decision to come to Sherbrooke, when, in September 1985, dean Pigeon delegated Dumais and me to the third meeting of the Network of Community Oriented Educational Institutions for Health Sciences. For two weeks, we worked on a detailed plan for implementing a Problem-based Learning (PBL) program, a valuable simulation exercise that sustained our action over the years. Six months later, Dumais agreed to head up the program. He too had decided to make the reform the major program of his career.

Action was interspersed with cherished times for reflection and analysis. Without wanting to generalize it, we view our experience as being valuable.

### Step 1: Perceiving the Need for Change

Over the course of their mandates, many faculty administrators have experienced the steps that we write about here. They have seen intentions for change come to life and die. They have received reports and proposed action plans. Then, the administration changes and the cycle starts over again. Outside accreditation committees are quite familiar with the process. In Sherbrooke, however, similar events led to reform being implemented.

### Making a Diagnosis

Sherbrooke's Faculty of Medicine opened its doors in 1966. By 1969, it had defined its institutional objectives, which were revised in 1972 and twice more in the nineties. The

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Faculty wanted to improve population health and health-care services through an integrated organ-and-system approach based on the Case Western Reserve curriculum model (Bussigel et al., 1988) and to identify specific objectives. Under this approach, students would acquire the training to understand and effectively act on the social and economic aspects of health care. They would practice self-directed learning both during and after their formal medical training. Memorization would give way to scientific reasoning. Students would develop an attitude and judgment that would enable them to grasp all the facets of problems they encounter. Multidisciplinary teaching methods would be used. A wide variety of options would allow students to follow their own particular interests from the first year. This means that the differentiation as researcher, teacher, administrator, specialist, or family physician could begin during the four years of the program.

In 1969, the MD program was built on mutidisciplinary teaching and left plenty of room for community health sciences. The planning document for the 1987 reform specifically referred to these objectives in order to provide a coherent link between the reform project and the historical development of the Faculty. These concepts clearly correspond with those stated in the introduction of the Association of American Medical Colleges' well-known *GPEP Report* (See Table I) (Muller, 1984).

Table I. Excerpt from the introduction of the GPEP report

<p>Each patient expects the physician to respond to the patient's personal concerns and problems on the basis of professional knowledge.</p> <p>Today's physician - and tomorrow's - is most likely to have acquired full knowledge of a medical specialty and to be challenged throughout his or her years of practice to keep pace with the expansion of science and technology in that specialty.</p> <p>The Association of American Medical Colleges...affirms that all physicians, regardless of specialty, require a common foundation of knowledge, skills, values, and attitudes.</p> <p>We believe that every physician should be caring, compassionate, and dedicated to patients - to keeping them well and to helping them when they are ill. Each should be committed to work, to learning, to rationality, to science, and to serving the greater society. Ethical sensitivity and moral integrity, combined with equanimity, humility, and self-knowledge, are quintessential qualities of all physicians. The ability to weigh possibilities and to devise a plan of action responsive to the personal needs of each patient is vital. Although every physician may not possess these ideal attributes in full measure, each physician is obligated to strive to attain and maintain these attributes.</p>
<p>Our reform proposal therefore should stem from the Faculty's philosophy and objectives, meshing with other revision activities. A 1982 review had already pointed to certain attributes future graduates should have: adaptability to change; training in biological and</p>

socioeconomic sciences and the humanities; development of values and attitudes desirable in health-care professionals; acquisition of learning and problem-solving skills; a scientific and critical approach; and the ability to work on multidisciplinary teams. Since most faculty members agreed on these values, there was no need to seek out new ones.

Over the next ten years, our Faculty would look at the MD program a number of times. Various reports showed the teaching staff that a review was needed. In 1982, a review committee conducted a study among teachers to determine what content was deemed essential. The committee concluded that the program length should be increased by 30%. This initial tentative was stillborn.

At the same time, another committee was reaffirming the 1969 objectives, which had been reviewed in 1972 - and recommended that the program load be lightened in order to train students to learn better on their own:

The MD program should still take four years to complete, although the load needs to be lightened. Many lecture courses give the appearance of a hodgepodge rather than a structured program, due to the lack of a definition of a whole... The Faculty of Medicine must urgently seek to establish with its future clientele an image of originality and excellence based on dynamic content and a motivated environment... Faculty administration should demonstrate that it values the teaching role and supports it with human resources in medical education.

That is how the Faculty identified the features of the «curriculum disease» then affecting the program (AAMC, 1984; Guilbert, 1981). The causes were multiple and linked to the divergence in evolution between the biological sciences and the health issues in modern societies. Medicine had divided into many different disciplines whose phenomenal growth led to what could be termed content hypertrophy, often the direct reflection of the power enjoyed by certain departments. Teaching focused on scientific microfields and led to various curricular distortions. Lastly, the system had become unyielding, centered on faculty, and resistant to any major change. The implementation of teaching innovations depended solely on the good graces of munificent teachers. The outcome: chronic disease of the traditional program presenting as excessive content; passive teaching, limited to lectures; and student evaluation focused entirely on memorization. Furthermore, there was no coherency between clinical instruction and the teaching of the basic sciences.

In 1983, our Faculty drew up a new list of problems affecting the curriculum, not unlike the one the year before: overloaded content, impoverished teaching techniques, evaluation that was incoherent with the objectives, lack of grounding in community issues, diminished student life, and so on. Just like a family that realizes that their current house no longer suits their needs, the teaching staff understood that the program had to be modified to respond to the modern needs of a rapidly changing society.

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## Undertaking a Process for Change

In June 1983, Dr. Pigeon accepted another term as dean. By 1984, he had signaled a new beginning for program revision.

Most faculties of medicine in North America have undertaken or completed reviews of their programs. Most of our faculty members believe that the MD program no longer responds to the faculty's current and future needs. A new direction and thorough review of the curriculum—on a continuing basis—is required and will promptly be initiated.

The message was unequivocal. Several months later, a new committee submitted its first report entitled *Orientation de la Faculté pour la révision du curriculum, document de réflexion* (faculty direction for curriculum review: a discussion paper). In this report, the committee stated that the program tended to «train» students instead of educating them. It further indicated that program revision should enable future physicians to deal with the many changes occurring in our society. In addition, the report's authors pointed out that the ultimate goal of the MD program wasn't to produce practicing physicians, which is an objective of postgraduate medical education. In reference to the MD program, the report goes on to state:

It is the only time in the medical-education continuum that allows the student to develop skills and qualities that are essential to practicing medicine later in his or her career, while using his or her existing knowledge to solve problems in a supportive context. Consequently, the student has the right to hesitate, make errors, and learn at his or her own rate.

The student benefits of this kind of education are critical mind, personal autonomy, creativity, and greater self-esteem. Our main educational challenge is not to socialize our students, but to educate them.

The dean insisted that each of the Faculty's and university hospital's departments discuss the report in departmental meetings and convey their reactions to him in writing. This broad debate allowed all interested parties to express their points of view. The committee's initial report led to the revision of the general objectives of the MD program and the profile of future physicians.

In response to this input, the administration had the Review Committee start over again. Its second report recommended that a series of guiding principles be acknowledged for designing the new program:

The program should be based on the needs of Quebec society and enable future physicians to acquire a general understanding of medicine. It should stress health promotion, the acquisition of scientific reasoning, and problem solving. It should foster the implementation of a multidisciplinary approach in seeking solutions to health problems. It should emphasize formative evaluation and self-assessment. It should guide career choices towards diverse disciplines. The teaching methods should nurture and maintain a spirit of discovery and self-directed learning. It should make it possible to learn time and resource management methods.

Once again, the various departments were required to convey their reactions in writing. The core of professors involved in the committee's work was already actively engaged in the change process. At the same time, the faculty was starting to position itself with respect to the needs expressed in 1982-83. While the administration realized that "the house no longer suited our needs", it had to consider the options. What kind of house should we be looking for? Should we move, rent, buy, build, or renovate? Analysis reveals that both the front-line teachers and the administration identified the needs. In the second phase, however, the faculty administration directly prompted the change. From a strategic standpoint, the dean appeared to want to involve all faculty members in each step and to set the pace for the process.

### Validating the New Direction

In 1984-85, the dean invited internationally recognized consultants to take part in in-depth discussions with faculty members on directions the program revision should take. This external validation process was effective: many teachers had the opportunity to compare their opinions with those of specialists able to position Sherbrooke's project with respect to international trends.

That same year, the Association of American Medical Colleges (AAMC) published its report on the general professional education of the physician at the dawn of the 21<sup>st</sup> century, commonly referred to as the *GPEP Report* (Muller, 1984). While the Sherbrooke reformers initially felt somewhat short-circuited, at the same time, the merits of their reflections were confirmed by this powerful organization that universally recommended a similar set of changes. The dissemination of the *GPEP Report* provided a focal point for elucidating new educational concepts to better inform and convince a larger number of teachers. The *GPEP Report* aimed at improving programs in order to promote the personal development and learning of each student. Our Faculty had already adopted them as guiding principles.

Our reform project took up the six elements of recommendation 3 in the *GPEP Report* relating to the acquisition of learning skills (See Table II). Once more, we used the same dissemination strategy, sending each teacher a copy of the *GPEP Report*. Again, the dean asked each department to convey their reactions in writing.

Our Faculty's need for change, validated by outside consultants, was already in-line with North American trends. All of the teachers knew that the AAMC contributed extensively to the Liaison Committee, which, every five to seven years, conducts outside evaluations of medical colleges and decides on their accreditation. A definite coherency was building under the pressure for change felt by every teacher as a result of the dean's strategy.

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Table II. Recommendations on the acquisition of learning skills

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1. Evaluate students on their ability to learn independently and provide them with opportunities to do so.
  2. Reduce the hours of activities on the school calendar to encourage autonomous learning with attainable objectives.
  3. Reduce the number of hours of lectures without replacing them with other specified activities.
  4. Offer experiences that promote independent study and active problem solving.
  5. Use teachers' subjective evaluation in measuring student analysis and problem-solving skills.
  6. Incorporate computer applications into medical education.
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## Conclusion

During this phase, a number of other activities proved to be necessary, in particular, workshops on introduction to teaching the health sciences and a basic training program on medical education. This heightened awareness of the need for change among more teachers (Chapter 8). It took two years (from 1983 to 1985) and three committees just to clearly identify the need for change.

## Step 2: Seeking Out and Selecting a Solution

The phase for philosophical debates wound down. The time had come to find dynamic, credible leadership to plan and implement a realistic, feasible reform within our Faculty. Redecorating or remodeling the house was not enough: the Faculty needed a builder with the ability to understand our aspirations and who would carry out the project according to our resources and timetable.

## Seeking Out a Solution

### *Hiring a project manager*

On becoming vice-dean education in 1985, I had the mandate of implementing the new MD program by September 1987. My other duties included supervising the graduate and continuing education programs, teaching development, and the undergraduate programs in biochemistry and nursing. The vice-dean therefore sits on all major committees: the

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dean's office, meetings of department heads, the space committee, and so on. The position is one of delegated authority; the incumbent exercises real influence.

#### *Building a core of innovators*

A committee comprising the dean, the vice-dean, the chair of the Review Committee, and a basic science teacher, and another colleague took charge of the project at that point. Right off, we referred to the theoretical framework for change (Levine, 1980) to fit our action into a planned process. By anticipating the next development stage, we were able to refine our frame of reference. From that point on and for the next seven years, Bertrand Dumais and I stuck to this strategic process.

A *Curriculum Framework Committee*, comprised of the initial core of internal agents for change, grew to meet specific objectives. In particular, ensuring that all the political forces within the Faculty were represented, including a group of faculty members and teachers involved in the reform. The committee had 18 faculty members, four students, and three resource people; all were appointed personally by the dean. The committee had a clear mandate to "develop a proposal for curriculum reform appropriate for the specific conditions at Sherbrooke".

## Selecting a Solution

#### *Developing a reward system*

While all this was going from 1984 to 1986, the Faculty administration set up a new reward system for university-related activities: teaching, learning, research, management, and professional activities. This system, which is discussed in Chapter 10, serves as a basic evaluation tool in faculty promotions. Teaching activities and innovations deemed superior or exceptional by one's peers are looked upon favorably when one is considered for associate or full professorship. Timing the implementation of the new recognition system to coincide with a major educational shift was strategic. It made the investment required of the teachers to implement the new program worthwhile.

#### *Deciding on goals and a reform model*

In January 1986, the Curriculum Framework Committee had four months to develop a proposal for change appropriate for Sherbrooke. The committee carried out its mandate in five steps.

*Step 1:* The committee studied the past reports and summarized the strengths and weaknesses of the existing program. A consensus emerged. The program should lead to the same level of skills as graduates from other medical schools and equip students to pass provincial and national exams. In addition, it should allow graduates to undertake graduate studies in clinical medicine, family medicine, or a specialty, or in health sciences administration or research. It was felt that the training should be community-centered,

based on problem solving and promote student autonomy. These were the four features that characterized the program proposal (See Table III).

Table III. Features of the MD program at the Faculty of Medicine of the University of Sherbrooke (1986)

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### **Patient-Centered Features**

1. Community-centered Learning
  - A program designed, administered, and oriented towards responding to health problems and needs of Quebec's population.
  - Early and continuing student exposure to the community to stimulate learning.
  - An educational strategy that promotes a global approach taking into consideration biological, psychological, and social aspects of the patient, while integrating preventive, curative, and rehabilitative care.
2. Learning that Fosters Humanism
  - An educational system that encourages students to broaden their humanistic outlook by developing a sense of respect for the values of others, the art of communicating with patients and their families, and communicating with their colleagues.
  - Educational activities that enable students to identify and improve their empathetic behavior.

### **Student-Centered Features**

3. Learning Based on Solving Problems
    - Learning focused on mastering the analytical and problem-solving processes to produce students that are skilled in formulating questions, producing hypotheses, and finding and analyzing the information required to understand a problem while integrating basic and clinical sciences to arrive at an appropriate decision.
  4. Learning that Promotes Autonomy
    - A selection of teaching and evaluation methods that promote progressive learning autonomy so that students acquire self-assessment and self-learning habits from the outset. This should enable them to identify educational needs and use appropriate resources for maintaining their skills throughout their careers.
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*Step 2:* Committee members received documentation providing details on the four project features. Each member had to acquire in-depth and comprehensive knowledge of each of them, and to be able to perceive their consequences, because they had to choose one feature on which they wanted to work.

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*Step 3:* Committee members paired off to analyze nine innovative programs from four continents. Each group had to summarize the features of their target program from the perspective that it was the best program and that there was no need for Sherbrooke to reinvent the wheel. The members then formed groups of three to compare three different innovative programs and three features of the Sherbrooke program.

*Step 4:* Each triad worked for three weeks to prepare their version of the new program.

*Step 5:* The triads presented their proposals for discussion. Finally, a preliminary framework for the new curriculum emerged as the basis for the reform project (See Chapter 2).

It was not until then that the three goals of the reform, arising from the four features of the proposed program, were formally stated (See Table IV).

Table IV. Goals of the program reform

1. *Promote autonomy in learning.* Pursuant to and in congruity with the conclusions of the various reports about the program revision, students should have greater freedom and responsibility in the learning process. Autonomy is the prime goal targeted by program change. Well before the *GPEP Report* appeared, the various medical schools in North America made student acquisition of attitudes and skills relating to autonomous learning part of their programs. We felt that this goal was crucial to the reform.
2. *Allow learning centered on the community.* The Faculty of Medicine at Sherbrooke has long been recognized for its special interest in community health sciences. In revising the curriculum, we wanted to give students earlier and ongoing contact with the various communities around the faculty. This would enable us to build a program that better responded to the needs of Quebec society by promoting an overall approach to the various aspects of its health issues.
3. *Develop a sense of humanism.* Because we shared the concerns of many medical educators and many intermediate bodies in our society, we wanted the new program to offer educational activities that would enrich students' sense of integrity and regard for the values of others, and to develop compassionate behavior in order to help them in their relations with patients, their families, and their communities.

### Step 3: Plan the Implementation of the Solution

The next step consisted in fleshing out the building plans. The program structure—really just a bare-bones picture—was greeted with interest when presented in a faculty assembly, although teachers felt that it was too general.

## Specifying the Solution

Summer 1986 saw the publication of a document (Faculty of Medicine, 1987) providing the thrusts, features, and goals of the program as well as an outline of the contents of the teaching units, learning milestones by phase, and guidelines for implementing the new teaching methods.

The Curriculum Framework Committee did not propose a new breakdown of material, deeming that it would be easier to implement the teaching reform using the systems/organ approach that had been used since the creation of the Faculty. The contents of the four-year program therefore remained basically the same, except the community thrust and the development of a humanistic approach. The "systems and organs" became "units" and the people responsible for them had to modify the contents accordingly.

The main modifications were:

- a significant reduction in the basic-science contents of the old first-year, yielding an eleven-week unit in medical biology; the remaining material would be integrated into the 14 other units;
- the addition of a clinical immersion rotation in first year;
- the modification of the sequence of teaching units; integration of basic sciences in problem solving; the introduction of periods for study priority health issues; the addition of two new units (the *growth-development-aging* process and *infectious diseases*); the definition of a twelve-week multidisciplinary problems integration unit in third year.

Reducing the old units by about 30% paved the way for the additions. The prerequisite skills for the clerkship are introduced during the first semester of the third year and the clerkship itself is twelve weeks longer. The mandatory rotations remain the same but have been shortened by one week. While optional rotations have been cut from 14 to 10 weeks, 3 mandatory rotations have been added: community health, family medicine, and primary acute care.

Reform proposals also targeted a major change in teaching methods and time allotted, in order to:

- integrate basic and clinical sciences;
- integrate clinic skills into unit contents;
- integrate bio-psycho-social aspects and preventive care into problem analysis;
- adequately represent all ages of life of a person in selecting clinical problems for each unit.

Problem-based learning (PBL) became the vehicle of change. PBL differs from the methods used in the traditional curriculum in a number of ways, as shown in Table V.

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Problems can be selected to ensure that learning is community-focused and presents a humanistic dimension. The PBL method also promotes the acquisition of self-directed learning aptitudes. As a consequence, students take an active role in defining study topics, managing the resulting information sources, and organizing their work time.

The reduction in time spent on structured activities transforms the student’s timetable. A typical week offers students significant time for independent study (See Chapter 2).

Student evaluation methods and frequency were completely changed in light of the new philosophy. Evaluation, weighted towards memorization under the traditional curriculum, shifted to ability to apply knowledge and problem solving under the PBL approach (See Chapter 5).

Table V. Comparison of a traditional curriculum to a problem-based learning program

	Traditional Curriculum	Problem-based Learning
Emphasis on	Imparting knowledge	Knowledge acquisition
Structure based on	Description of disciplines	Integration of disciplines
Cognitive sequence	Facts and theories precede their application	Application concurrent with assimilation of facts and theories
Centered on	The teacher	The student
Topic selection	Teacher alone	Students contribute to defining the topics
Focus	On covering contents	On covering contents and on learning processes
Evaluation	Summative	Formative and summative

In actuality, the initial project was implemented with very few modifications. As part of a deliberate strategy, the shift to PBL was the sole change; the other two goals of the reform - strengthening links to the community and developing humanism - were put on the back burner. Besides, when the proposal was first presented, the teachers complained that it put too much emphasis on social aspects of medicine. They claimed that we would be training "alternative" doctors! Some dug in their heels, especially basic science teachers. Be that as it may, limited resources kept us from implementing all the changes at the same time.

We were counting on subsequent waves and additional maneuvering room to prevent rigidity from setting in again in the curriculum.

## Fostering Acceptance of the Reform

A series of actions during the 1986-87 school year left no doubt as to the dean's political will. While an official decision was still pending, everything was set into motion to implement the reform in September 1987. In a tour lasting two months, we met with each of the 37 departments and services, both clinical and basic sciences, to explain the proposal described in *Document n° 1*.

It was rough going in some meetings: we were peppered with objections about program structure and content as well as about the basic principles involved. Regardless, we never took a confrontational stance. Instead, we strove for attentiveness, patience, understanding, and tolerance. We greeted the objections with discussions about the trends in medical education, the PBL frame of reference, faculty decisions about the "disease of the curriculum", and the mandate to reform the medical program.

September 1986 - just under a year to the crucial implementation date—faculty members were gripped with concern, even anxiety. This period of instability would last nearly two years! The year before and after implementation were critical. We seized every opportunity to make our colleagues aware of the benefits of the reform. The reform project fueled discussions from the hospital cafeteria to the faculty lounge. Die-hard opponents maintained that research programs would be compromised and that the *Société des médecins* (See Chapter 10) was headed towards bankruptcy! Many leading colleagues and some department heads advised us to proceed cautiously. We were entering the critical phase of an adventure well underway. It was time to get the troops ready.

Implementing the reform required the cooperation of a well-trained teaching staff. The classroom role of the teacher would be greatly modified since lectures were giving way to small-group learning. We all had to become familiar with the role of the tutor or learning facilitator. Since PBL involves using the Socratic method, in which the teacher guides the student through questioning, our teachers needed to acquire new skills. Professor Henk Schmidt from Maastricht (the Netherlands) was brought in to introduce the teaching staff to the PBL method (See Chapter 8). In 1986-87, the Faculty hired a continuing education consultant for the tutor training program.

PBL empowers students to a large extent, so teachers must clearly understand the principles on which the learning is based. Consequently, many introductory workshops on teaching health sciences were offered. Most faculty members and nearly all of the future first-year teachers were attracted to the great number of teacher training programs.

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## Undertaking Implementation Planning

Preparation of the PBL units for first-year students began in June 1986. From that point on, program implementation depended on the teaching staff. The unit committees, made up of clinicians and fundamentalists, and supported by a family medicine teacher, went to work.

In an effort to increase visibility of the proposed reform and to motivate all groups of teachers to take part in it, the Faculty decided to initiate a series of «launchings» to kick off the unit committees. Twelve to fifteen months before the start of the first semester of the reform, each committee was invited to attend an event that was both social and informative in nature. These events provided an opportunity to explain committee mandates and the steps in building the unit.

Three such launchings were held in 1986-87. During each of them, the dean invited the teachers to develop a high-quality program. Each of the committees received a twelve-step process for carrying out their work (See Appendix 1).

The committees did not work in a vacuum. After the launching, committee members were asked to take part in a day-long workshop on problem construction. Their work was closely monitored by the Validation Committee. Then, the Program Coordination Committee checked the contents, structure, and coherency with respect to PBL and the spirit of the reform. Each unit leader had to justify his or her choices, explain the sequence of problems, and make any necessary modifications. This way of working was given priority throughout reform implementation.

*Classrooms!* With the introduction of PBL, the four amphitheaters, built in the early sixties, were suddenly outmoded. The need was for smaller rooms - at least twelve for the first year of the new program, then two or three times as many for subsequent years. We were able to reserve the rooms necessary for the students to work in small groups, at least for the first year.

*Student Evaluation!* Problem based learning also had an impact on student evaluation, which, up until then, had focused solely on memorization. To help us out in this regard, we called on Nu Viet Vu, who was working at Southern Illinois University with Howard Barrows, one of the pioneers of the PBL. That's how, in January 1987, an evaluation committee identified the aims of the evaluation and the conditions for its implementation (See Chapter 5). But the teachers felt ill-equipped for dealing with evaluation. They couldn't see how to maintain coherency between the learning method and evaluation. Neither were they sure of how to come up with reliable and valid techniques that would take into account the difficulties that teachers would have in developing evaluation tools.

Two things were apparent. First of all, the tutor would surely be able to judge student progress, problem analysis skills, and ability for communicating with peers. Consequently, there was decided to give adequate weighting to tutor evaluation of students. Secondly, it would be logical for evaluation to look at the student's ability to analyze problems, as is done in tutorials<sup>1</sup>. This meant that short-answer and open-ended questions had to be converted into problem analysis questions (PAQ).

It took 16 months of planning to get program reform to the point that we were able to begin implementing the first year. Everything had to be done at the same time: doing the groundwork, providing teacher training, fleshing out plans, selecting materials, developing problems, and meeting with faculty members to demonstrate how they would benefit from the improvements. The approach was based on drawing in as many faculty members as possible.

### Step 4: Adopting the Solution

Study programs in North America do not fall directly under national departments of education or even major disciplinary associations as is often the case in Europe. On the question of the quality of their programs, universities in Quebec answer to the *Ministère de l'Enseignement supérieur et de la Science* (provincial department of higher education and sciences), the accreditation bodies of professional societies, and the general public. The university sets program contents and evaluation methods; it admits students and awards degrees and diplomas; and it approves programs and ensures that their quality is maintained. Before our new program could be implemented, it had to get the approval of the administration of the University of Sherbrooke.

### Making the Rounds of Official Decisions

The dean made the rounds of the various university authorities to the proposal had been submitted for official acceptance.

The Faculty Council, whose members include students and faculty members as well as representatives of the faculty administration and affiliated hospitals, advise the dean on managing Faculty business. As a matter of course, department heads do not sit on the board, which is why the Faculty instituted an Assembly of Department Heads (ADH). Although

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<sup>1</sup> Webster's Third New International Dictionary, (Springfield, Mass., Merriam-Webster Inc., 1986) defines tutorial as "a class or seminar that is conducted by a tutor for a single student or a small number of students and that consists mainly of discussion or individual instruction". We use "tutorial" herein to mean a "structured discussion" of a problem by a small group of five to twelve students and an instructor, referred to as a tutor, conducted to analyze or resolve problems using the existing knowledge of the participants and by identifying study objectives.

it was an unofficial, advisory body, for all practical purposes, the ADH had a good deal of power. In January 1987, the dean's office officially approved the program proposal with a view to present it to the ADH.

During the meeting, the department heads expressed their concerns about the new system: it would monopolize faculty time, be detrimental to graduate training programs, compromise research, and even significantly reduce clinical practice, which would have a negative effect on the income of the *Société des médecins*. In the end, however, they approved the new program.

A few weeks later, the Faculty Assembly, which takes in all full- and part-time clinical teachers and fundamentalists<sup>2</sup> met. Their interest was not as strong. While many members were absent and others expressed resistance, they finally agreed to take action.

Members of the Faculty Council were less concerned about resources than student evaluation and difficulties that students might have in adapting to the new system. Student representatives feared their peers would bear the brunt of program experimentation. Finally, they accepted the proposed program with the condition that the Council be kept apprised of progress throughout implementation. The proposal was adopted and then sent on to the University Council.

The council advises University administrators on matters pertaining to programs of study. If they deemed that the proposal constituted a *major* change, it would have to go before the Conseil des Universités du Québec as well. Our Vice Rector for Education felt that it was a *minor* change because the contents of the MD program hadn't been substantially changed. Neither were its length or evaluation methods, which maintained the same class and grading system. While the decision made our lives easier, one had to wonder if they realized just how much the new program was going to change the learning and teaching process.

There was one last authority to convince: the University's Board of Governors. A companion document, written on the spur of the moment, proved to them that the implementation of the new program would require no new funding for two years, which was a last-minute stipulation by the Rector. The Board of Governors gave us the go-ahead.

In April 1987, a new cohort of 100 students enrolled in the new program slated to start on September 1. It was time to rethink all the components of the old system. To go back to our renovation analogy, all the old furniture had to go.

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<sup>2</sup> Teachers of basic science.

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## Implementing the Solution

*Document n° 1 sur le projet de réforme* (Faculté de Médecine, 1987) presents estimates of the faculty time required under the PBL and lecture-based system that indicate that PBL could involve more faculty time. Lecturing under the old program required just 1645 teacher-hours. This does not take into account that each teacher was allowed two hours of preparation for every hour of class, which means that lecturing actually required nearly 5000 teacher-hours. Once the PBL problems have been developed, however, tutorials should not involve very much preparation. This gives us 3120 hours for PBL to 5000 hours for lectures, representing a hypothetical reduction of about 40% (assuming that everything remains the same). In reality, each tutorial would take three hours instead of the estimated two. Very early on, we also realized that we needed to decrease the number of students per group from 10 to 8, which increased the number of tutors.

Tutors were initially recruited on an individual basis in order to attract teachers who would facilitate the implementation of PBL. Almost all of the basic science teachers were in the medical biology unit; only 35% of them participated in the other units. The ADH was quick to react to this recruitment method, so we had to find a better one.

In May 1989, the ADH accepted the list of tutors for the following year - drawn up by program leaders - with the condition that it first be submitted to department heads. They would have the right to recommend different tutors or to move some into other units. In this way, everyone would be able to participate in undergraduate training and take advantage of the associated "academic units" (See Chapter 10).

When the school year started in 1987, the 100 students in the first cohort were there. In a short time, they proved to be one of the most valuable assets in changing the program. The layout of the university hospital, which houses the Faculty of Medicine, facilitates contacts. The second-floor hall connects the clinics to Faculty administrative offices. It was an especially good place to take the pulse of the reform, as was the faculty lounge.

Implementing the medical biology unit was the greatest challenge of the whole undertaking. Many of the basic science teachers were anything but convinced of the soundness of the PBL method. They reluctantly assumed the role of tutor. The material taught in the unit was not integrated and did not seem related to clinical reality. How did we get through this phase? Some told the students that they would not learn anything under PBL. Others, however, were amazed:

These students are just unbelievable. In the past, I taught them for 15 hours and they always asked unimaginative questions. This time, I developed a single problem. They stuttered through the first tutorial, then went off to study for two days. They came back brimming with intelligent questions. They had learned more than they would have in 15 hours of lecture!

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It shows the power of a teaching method that allows students to learn the material and discuss it intelligently.

The first semester was hard. The teachers were demoralizing the students by constantly repeating that they had 10 weeks to learn what past students learned in a year. Although the PBL method had been implemented, program development - especially the development of problems - fell short of the mark (See Chapter 11).

## Experiencing PBL

One phenomenon kept coming up throughout the implementation period: teachers did not really see the power of PBL, the autonomy that the method instilled in students, and the emotional equilibrium that students needed in preparation for the day that they would become tutors themselves. Despite initiation workshops, tutor training, and testimonies from colleagues, teachers had to experience PBL in order to trust the method.

Whether we wanted it or not, the first cohort of students benefited from the program because they often served as instructors for their teachers in teacher training workshops. Students, through their reactions, comments, and criticism, modeled tutor behavior and contributed to the assimilation of the new training system. This interaction illustrates why some promoters of the curriculum change proposed a strategy that involved parallel tracks (Kantrowitz et al., 1987) they counted on the students to training the teaching staff.

Many faculty members, especially those who felt they bore the greatest burden in transmitted contents, waited to see for themselves how the students would "learn" the material before adopting the program. As a result of teaching their units, about 80% of teachers adopted the program and sometimes even became promoters of it. It took a full sequence of 14 units and 2- years before most teachers felt comfortable with PBL in the first round of implementation.

Implementation of the multidisciplinary problem integration unit during the third year (Unit 14) proved very revealing in this regard. If PBL actually fosters the development of a kind of complex expert system in the minds of students that allows them to analyze clinical problems and that stimulates the acquisition of autonomous behavior, then, after finishing the PBL preclinical phase, students should be able to intelligently discuss complex multidisciplinary problems, such as during clinical pathological conferences. Unit 14 proves that this is the case. The students astonished their teachers with their structured analyses of difficult pathological conditions.

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Class Picture. The new program got underway in September 1987. The first cohort, the members of the Dean's Office, and program administrators appear in a traditional class picture.

## Monitoring Implementation

Once a major reform like this has been implemented, its position is still far from secure because there is a tendency to revert to traditional teaching; erosion of the new system sets in. The energy that spurred development has been expended and must be replaced. This evolution shows up in program evaluation (See Chapter 11) and in the questions that program promoters ask themselves (See Chapter 13).

## The Turning Point

From September 1987 to June 1990, experiencing PBL - the fourth step in the strategic planning of this major educational change - required the participation of a large number of teachers, either as unit builders or tutors. The turning point in the success of the reform was when those involved were able to experience the PBL method for themselves.

The following table provides the breakdown of the collective actions that, from 1983 to 1990, enabled us to work through the various steps leading to major educational change. This chapter covers only the first three steps. The remaining chapters recount more specifically actions taken starting in 1987.

## Steps in the Strategic Planning for Change

I. PERCEIVING THE NEED	ACTIONS IN 1983-1985
* Carry out a diagnosis	- Review Faculty goals
* Undertake a process	- Identify the "disease of the curriculum"
* Validate the orientation	- Distribute the dean's policy statement
	- Produce reports about the reform
	- Invite outside consultants to take part
	- Distribute the <i>GPEP Report</i>
II. SEEK AND SELECT A SOLUTION	ACTIONS IN 1985-1986
* Seek a solution	- Hire a project manager
* Select the solution and develop it	- Form a core of innovators
	- Work out a reward system
	- Determine the reform goals and model
	- Set up a Curriculum Framework Committee
III. PLAN IMPLEMENTATION OF THE SOLUTION	ACTIONS IN 1986-1987
* Specify the solution	- Specify the plans for PBL units
* Promote acceptance of the reform	- Affirm political will
* Undertake planning for implementation	- Meet with departments
	- Train PBL tutors
	- Build PBL units and develop student evaluation
IV. ADOPT THE SOLUTION	ACTIONS IN 1987-1990
* Making the rounds of official decisions	- Propose adoption by Faculty committees and University administration
* Implement the solution	- Hire PBL tutors
* Monitor implementation	- Initiate the program on September 1, 1987
	- Experience PBL
	- Determine what to evaluate

## Conclusion

In following the evolution of a major educational change, the reader might be led to think that the steps flowed sequentially. Despite appearances and the fact that the process was planned, steps tended to overlap. To illustrate, we started building the units for the first year while we were explaining the rationale for the change and developing overall program contents. The early adopters were not afraid to get to work. The process for change that we implemented could be viewed as a series of overlapping loops. The time frame forced us to do everything at the same time. Reforming a medical curriculum is a risky business (Barrows & Peters, 1984).

Be that as it may, three significant events confirmed the viability and vitality of our educational reform. In spring 1989, for the first time in their history, the Committee on Accreditation of Canadian Medical Schools and the Liaison Committee on Medical Education (its American counterpart) jointly awarded our program complete and unconditional accreditation for seven years, even if it included implementation of PBL. The University of Sherbrooke and its Faculty of Medicine, which draws in 45% of the institution's research funding, saw their research performance grow at a faster rate than any other Canadian university from 1982-89 according to *Science Watch* (1990). In September 1990, the students who opted for Sherbrooke's medical program ranked higher than any other preceding class.

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## Appendix 1

### Guidelines for Unit Committees to Carry Out their Mandates during the Initial Implementation Period of the New Program

1. Identify the unit *contents* (the material, the area to cover). This could consist in a contents table or grid several pages in length. The concept is to stress the principles and mechanisms to be mastered rather than information to be memorized. Basic science must be integrated into the clinical problems.

During the preclinical phase, the focus is on mechanism, the concepts that account for the symptoms, signs, evolution, and behavior - not on lists of symptoms, signs, investigations, and prescriptions to be memorized.

The spiral concept proposes continuous learning throughout the four years of the program. It is no longer a question of attempting to teach everything during the first two years.

2. Check the *relevancy* of contents by having them reviewed by a physician from another discipline or assessed by practicing physicians outside the academic community. The idea is to ensure that clinical problems touching all ages in the life of an individual are adequately represented. Moreover, the problems must foster the integration of preventive and psychosocial aspects as well as add a human side to the situation.
3. Convert the table of contents into concepts and mechanisms that the student must master. This makes it possible to draw up the list of concepts.
4. Read the kit entitled *Critères de choix pour l'identification des problèmes pour l'apprentissage par problèmes* (selection criteria in identifying PBL problems), containing two articles on cognitive psychology and two on community health.
5. Develop a series of *problems* that, when analyzed by a group of students, will allow them to acquire the proposed concepts.
6. Specify the *sequence* of problems, providing justification for a logical pathway for acquiring the knowledge and for mastering the concepts. Take into account that, in order to be mastered, new knowledge must be "grafted" onto existing knowledge and enable the students to establish new links between pieces of knowledge.
7. Draw the list of concepts that will not be dealt with using PBL problems. Develop *learning activities* (especially *self-directed learning activities*) that will enable students to acquire the concepts.

8. Plan for *formative-evaluation* activities over the course of the unit.
  9. Design a program of activities to stimulate student motivation in the learning process.
  10. Fill out the *Unit Handbook*, which provides the list of problems, support material, problem sequence, self-directed learning activities, reference documentation, other resources, formative evaluation sheets, weekly timetable of activities, and the final evaluation method. (The *Tutor Handbook* also contains the list of concepts and the list of mechanisms that must be mastered.)
  11. Prepare the *final examination* to measure mastery of concepts, acquisition of a knowledge base, the capacity to apply the learned notions in analyzing and solving unit problems.
  12. Identify problems that should be dealt with in the *multidisciplinary problem integration unit* (Unit 14).
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## PART TWO: CONTENTS OF THE REFORM

### The Preclinical Training Program: Orientations, Activities, and Administration

Bertrand Dumais, Jean-Pierre Bernier and Jacques E. Des Marchais

*Education is what is left over  
from what has been learned and forgotten  
-Paraphrase of B.F. Skinner*

In the early eighties, the Faculty felt the need to make major changes in the MD program in order to bring it into line with new trends in medical education and societal changes in Quebec. This revitalization could have adhered to the overall plan for the old curriculum, while introducing significant modifications in the sequence of various components. In fact, that was the path chosen for overhauling the clerkship program (Chapter 7). As for the reform of preclinical training, those in charge of the program opted for an approach that consisted in razing the old structure in order to build a new one. It was a radical, uncompromising approach.

When you decide to build a new house -which is what happened in the case of preclinical training- a number of parallel processes must take place at the same time. The first is self-assessment. Is there any way to do better with the resources that we have in comparison to standards in medical education? Can we do better by making better use of talents in the university community and by working with outside authorities sympathetic to our concerns? What goals should we set to ensure that we succeed? We felt that our proposal for changing the training program had to provide added validity to the overall structure. In other words, our students had to be trained in contexts and according to principles that would be representative of their future practice of medicine.

The next step consists in sitting down at the drawing table and designing a mockup. This systematic approach implies determining the goals and then the orientations, which will become the general objectives to be achieved. The next step is developing teaching methods and putting together a sequence of specific activities that will occur according to a set timetable. An appropriate administrative structure ensures that the activities are coherently coordinated.

## Program Goals

Training competent physicians is inevitably the ultimate goal of any medical program. By the end of their training at the Faculty of Medicine of the University of Sherbrooke, we wanted our students to evidence three major qualities, in addition to skills in diagnosing and managing the sick: mastery of self-directed learning, a genuine concern about health-care problems in Quebec society, and a constant demonstration of humanistic attitudes in their professional lives. This triad became the anchor point for the new program (Faculty of Medicine, University of Sherbrooke, 1987). They guided Faculty decisions during the years when the reform was being implemented.

### *Mastering self-directed learning*

In a society that is constantly evolving -especially in an area of science in which knowledge and techniques advance and change at an accelerated rate- self-directed learning stands out as a determining factor in an individual's ability to adapt to the environment. This kind of autonomy is gradually acquired through personal, voluntary, and conscious effort. In education, self-directed learning can be viewed from two complementary standpoints: goals and the learning process. The most important thing, in our opinion, is that self-directed learning be considered one of the goals of medical education, not only at the undergraduate level, but especially at the graduate, both in family and specialized medicine. As a result, an autonomous physician should, by the end of his or her training, evidence a set of attitudes that foster self-directed learning (See Table I).

Table I. Attitudes fostering self-directed learning

RESPONSIBILITY:	Being aware of the need to take steps to maintain and develop competence.
OPENNESS:	Being attentive to seize learning opportunities.
MOTIVATION:	Having the desire to identify learning needs and to develop strategies for responding to them.
ORGANIZATION:	Placing priority on learning while maintaining a balanced approach to time management.
DISCIPLINE:	Having the will to develop self-assessment and self-learning skills.
CONFIDENCE:	Feeling assured in one's ability to learn effectively.

These attitudes show up in a range of specific skills (Boud, 1988) (See Table II).

Seen from this perspective, should self-directed learning not fit into the characteristic objectives of all educational systems since capacity for autonomy in action is what defines a professional? In preparing to embark on their medical training, many students have had to develop their self-determination often years earlier in order to be admitted to medical school. They put aside other career choices and made the effort required for admission.

Table II. Skills specific to self-directed learning

Self-evaluation and identification needs
Accurate formulation of learning issues
Selection and use of appropriate resources
Selection of relevant, effective educational activities
Identification and rapid rejection of irrelevant material
Critical application of new knowledge to clinical problems
Evaluation of steps

*Real concern about community health problems*

Future physicians are trained in faculties of medicine and affiliated university hospitals that are usually located in major urban centers. Faculty members are nearly always teachers of basic science or clinicians, who are often highly specialized. Basic science teachers concern themselves with advancing knowledge in major areas, but often they are not in touch with current health issues. Specialists, on the other hand, treat patients with illnesses that are often serious, rare, and with complex interrelations. They use costly, sophisticated diagnostic technology that is rarely available outside of tertiary-care (highly specialized care) hospitals. Inevitably, these teachers tend to favor topics and contexts that match their professional interests. As a result, graduates risk completing their training without being exposed to the community settings in which they will have to practice and without being familiar with the many problems that they will face. Faculty members, with the exception of community-health specialists, also tend to concentrate their efforts more on the disease rather than on health and to place more emphasis on the curative than on the preventive model.

Some training analysts have observed a growing discrepancy between community health issues and the daily activity in medical faculties and university teaching hospitals. Two approaches can be used to remedy this problem: equip future physicians with the

knowledge and procedures that they need to effectively contribute to the solution of health problems in their communities or offer medical education -especially the clinical aspects- in the community (in other words, *community-based* medicine). The second strategy makes it possible to imprint on the physician's mind not just the relevant information, but also will be available human and material resources.

Since both approaches have advantages, we did not hesitate to draw on them in enriching our reform. By the end of their training, we want students to have acquired the basis on which to become *physicians* capable of actively contributing to the *promotion of health*. In addition to proving competency in managing patients, graduates must be interested in maintaining the health of their patients and in disease prevention. They must take part, within the scope of their qualifications, in planning health-care services. They must be able to deliver appropriate "instruction" to patients and their families. They must foster the application of preventive measures. This education includes the promotion of healthy lifestyles, in particular, identifying and controlling risk factors in accordance with scientific epidemiology data.

Although graduates may not be specialists or researchers in community health, they should demonstrate openness in cooperating in the identification of the health needs of the populations that they serve. Graduates should be ready to offer responsible co-operation in the collecting that data needed to formulate priorities. They should strive to make patients aware of the importance in participating in epidemiological surveys and the reliability of diagnostic technology or treatment.

They actively listen to the perceptions of the public and health-care advocacy groups and are attentive to their reasons for their dissatisfaction with respect to the practices of the medical profession. Graduates should develop skills that enable them to smoothly communicate with other health-care players in order to make them aware of the scientific perspective of a medical issue.

Concern about community health problems can only be translated into a commendable or passive interest in advances in community health sciences or interdisciplinary practice. In order to have a real impact on medical practice, this concern must be reflected in certain qualities of the graduate that are evident in daily activities. In addition, it implies competent, integral management of the patient and is manifested by continuity of care and adaptation.

Physicians, throughout their careers, must strive to maintain their skills. Their practice of medicine must therefore evolve in order to adequately respond to new scientific standards. By updating their knowledge, physicians help define new standards for practice. Their active participation in this critical process enables physicians to use the limited resources of the health-care system more wisely.

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Lastly, but from the outset, graduates must define a mode of practice that will respond to the conflicts that, without a doubt, will arise between their personal preferences and interests and the needs, expectations, and socio-economic conditions of the areas in which they will practice. This calls for an attitude that meets health-care service priorities as well as their strategic adaptation, such as in participating in controlling their cost to the public health system.

*Constant demonstration of humanistic attitudes*

Medical humanism conveys the physician’s inner orientation that leads him or her to put the patient as a person at the center of his or her daily concerns. This attitude is expressed in the respect of the freedom, dignity, values, and system of beliefs of an individual. This conception of medical humanism will be formulated in the components and frame of reference (See Chapter 6) (Pellegrino, 1979). The expression, by medical students and physicians, of humanistic behavior refers to a series of attitudes and skills summarized in Table III.

Table III. Humanistic behavior

Intellectual integrity towards oneself and others
Respecting the values of others
Ability to communicate and listen
An empathetic, balanced way of responding to a problem or need

*Intellectual integrity towards oneself and others*

For students, this consists in a personal commitment to demonstrate honesty and exactness in their learning, their problem analysis, and the assessment of their knowledge, skills, and abilities. Students should feel free to admit that they do not know something. Recognizing one’s limits and using means to compensate for them are basic attributes of integrity. Intellectual integrity has an essential moral dimension; it must be identified in candidates for medical training and assessed. Neither should the psychological aspects of metacognition and motivation be neglected, since they are necessary for the maturation of these aptitudes in students. Their acquisition can certainly be misdirected through intellectual activities of lower taxonomical level in the cognitive domain and by overemphasizing the competitive nature of the evaluation system.

*Respecting the values of others*

Respecting someone’s choices presupposes an interest in finding out more about the types of values common to different groups of people based on their ethnic backgrounds, where

they went to school, social status, level of education, and so on. Such behaviors and attitudes call for open-mindedness and general knowledge that should be expected of students admitted to medical school. Medical education and practice must further develop this characteristic. Program activities must contribute to its development by providing students with suitable conditions and convincing situations. Vigilance is even more important since the profession in general, even university teachers, derives part of its effectiveness from its constant focus on accurately distinguishing the normal from the pathological. Applying this dualistic approach in the sociocultural and ethical fields runs the risk of producing nothing positive and yields a normative attitude and certain intellectual conservatism.

#### *Ability to communicate and listen*

Practicing medicine requires a basic skill: being able to perform an interview with genuineness. This means being able to gather the information needed to diagnose a problem and find a remedy (See Chapter 4).

Communication does not mean just running through a questionnaire. Students must not just ask questions, but actively listen and react with genuineness. The approach must be comprehensive: the individual patient must be every bit as important as his or her illness. This communication skill must also extend to the families of patients, colleagues, teachers, and other health-care professionals.

#### *An empathetic, balanced way of responding to a problem or need*

Empathy can be defined as the ability to identify with someone else, perceive what they are feeling, and put yourself in their place with their intelligence and sensitivity.

Students do not acquire this kind of professional behavior solely through the spontaneous maturation of innate qualities. They must acquire the knowledge and know-how needed to identify patient needs and to respond to them in a manner consonant with the patient's problem. The process is active, conscious, and responsible.

These are the three major qualities that should distinguish physicians trained at the University of Sherbrooke. What type of program best fosters the acquisition of these specific qualities while ensuring that medical science is mastered? This is the question that we will now address by discussing the selected learning methods and describing the three major orientations guiding the development of the new program.

## Distinctive Program Orientations

In 1986, once consensus on the main qualities of future physicians was arrived at, faculty members began sketching out the principles that would guide the planning and building

the new MD program. This led to the formulation of three distinctive orientations. The program would be centered on students and the community, and advocate medicine dedicated to patients. The orientations served as guides in the planning, implementation, and internal evaluation of the new program's activities.

### *A student-centered program*

A traditional curriculum usually restricts students to a passive role. In lecturing, the teacher selects the learning objectives, asks questions, and provides answers for them. Students either transcribe the material or follow it word-by-word in a massive syllabus, which makes consulting reference books practically useless. Class notes take the place of study objectives; passing exams is based on memorizing them. Days are filled with classes; evenings with reviewing the material seen during the day.

In order to offer a student-centered program, we opted for the *Problem-based Learning* (PBL) method (Barrows & Tamblyn, 1980). The method is taught to students in the first week of classes and is immediately applied. The method is used throughout the first two and one-half years of preclinical training, although applied in two different ways. During the first and second year, PBL focuses on analysis. In the first semester of the third year, we introduce problem solving learning (PSL). These two methods, which are described below, are analyzed in Chapters 3 and 13. The reform of the clinical phase, based on the same principles, gave rise to a third application of PBL that we call clinical reasoning learning (CRL) (See Chapter 7).

Because of the major role attributed to PBL during preclinical training, the watchwords for this period were problem analysis and resolution, work in small groups guided by a tutor, self-directed learning, and self-evaluation of knowledge and skills. The method puts students face-to-face with the problem. They have to analyze it, ask questions, take stock of what they already know, and seek out what they need to know. Then, they consult reference books to find answers to specific questions. The teacher's prime role is not to convey knowledge but rather to guide the learning, analysis, and problem-solving processes. Students in a PBL program have to participate actively. They reason out loud, analyze, and use concepts to account for clinical situations. They are guided by a sequence of didactic problems grouped into units. This kind of system allows students to acquire the basis for self-directed learning.

### *A community-based program*

Medical education proposes different models for community-based programs (Engel et al., 1992; Nooman et al., 1990). The one that we chose is suitable for a medical faculty serving an industrialized North American society. Of course, this type of medicine has specific characteristics, such as ease of access and high technology. The infant mortality rate is quite low; life expectancy is 84 years of age for women and 76 for men. Physicians under this model are fairly dependent on sophisticated technology, which is a major factor

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in the growing concern about health-care costs. Moreover, health-care system managers want to implement a more balanced regional distribution of medical resources. Since they are distinctly influenced by community-health approaches, managers hope to achieve a more equitable distribution of the public-health systems limited resources. They believe that more resources should be committed to health maintenance, disease prevention, and promotion of the quality of life. Rising health-care costs should be curbed by proportionally reducing the resources invested in developing technology and in curative medicine in general.

Deciding to center our new program on the community led us to develop educational activities that either have a community focus or take place directly in the community.

The problems selected for PBL in community-oriented educational activities must correspond to priority needs in the community. The goal of student participation in these educational activities must be initiation to community-health problems and development of the habit of promoting health and preventing disease. Through specific interdisciplinary activities, students develop the attitudes and skills needed to effectively work with other health-care professionals.

From the outset of their training and every year thereafter, students work in the community during rotations in health-care centers and general hospitals throughout the province of Quebec. These regions inevitably have fewer resources both in terms of medical staff and the latest medical equipment.

#### *A medical program that serves the patient*

We wanted the program to go beyond the traditional biomedical and psychomotor cognitive components in building clinical competencies to include knowledge and relational approaches characterized by humanism applied to medicine. While the goal of training "good doctors" still stands, their knowledge and repertory of interventions must be broadened to include a fuller definition of human relations. In our opinion, the training components that foster the behaviors that should be evident in a "good doctor" contain the elements described below.

First of all, knowing how to communicate with patients and their families, colleagues, teachers, and other health-care professionals. Secondly, being honest with one's self and having intellectual integrity in any activity governed by rules of conduct, both as a student and later as a professional. Early and ongoing practice of PBL, working in small groups, self-directed learning, and student formative self-assessment provide a rich environment for developing these attitudes. Thirdly, respecting the values of others in any professional activity. The directions of the new program can then be linked to the qualities targeted in new graduates (See Table IV).

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Table IV. Program orientations and qualities of graduates

PROGRAM ORIENTATION	QUALITIES OF GRADUATES
- Student-centered	- Learning autonomy
- Community-based	- Community focus
- Focused on the patient	- Humanistic behavior

The Sequence of Activities

As in most medical schools throughout North America, our MD program runs for four years (See Fig. 1). At the end of their training, our students must pass a comprehensive examination. Nearly all the students, without being required to, sit the Qualifying Examination of the Medical Council of Canada. The program consist of two major phases: two and one-half years of preclinical training, followed by one and one-half years of clerkship or clinical training (See Table V). In order to earn a license to practice medicine, graduates must successfully complete a graduate training program that lasts two years in the case of family medicine and four to six years for specialties.

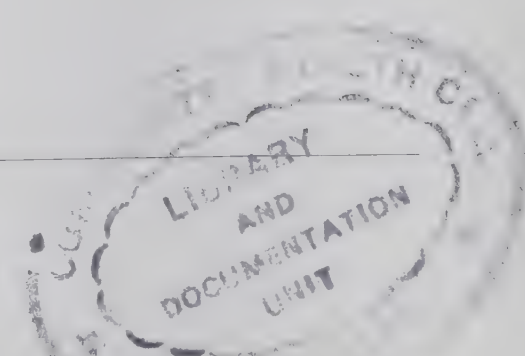
Preclinical Training

Preclinical training comprises three phases. Phase I lasts for one semester and serves as an introduction to the program. Phase II runs from January of the first year to June of the second, comprising a series of 13 units structured around systems. Phase III, centered on integration, takes in the first semester of the third year.

Phase 1: Introduction

The first phase provides an introduction to the learning methods and familiarizes students with medical biology; the semester ends with a clinical immersion rotation.

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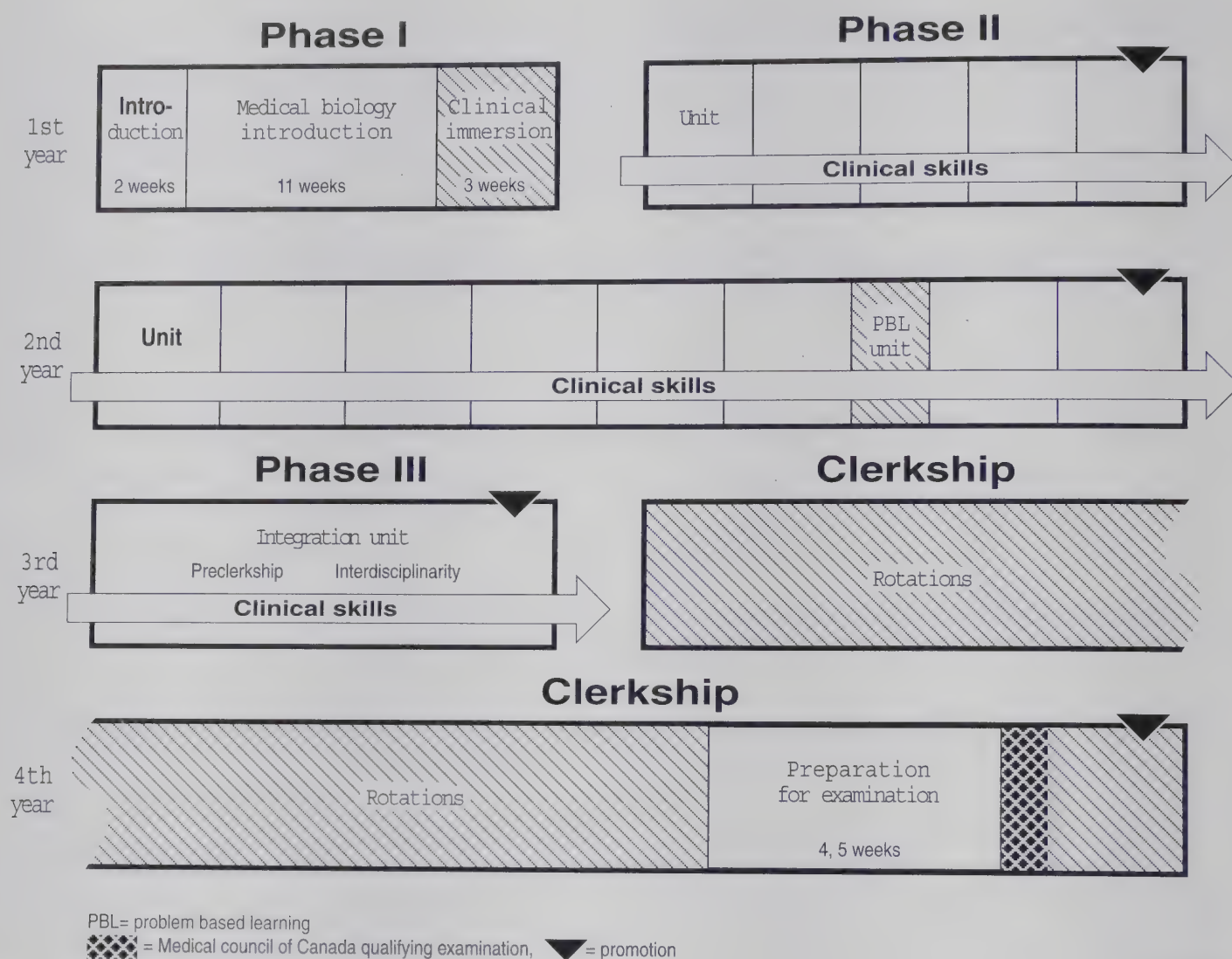


Figure 1. MD Program

### *Initiation to learning methods*

Student training begins with two weeks of orientation on the program, Problem-based Learning (PBL), and working in small groups, presented as a workshop for the entire class. Students first assimilate the general principles of the learning processes, the rules governing group dynamics and operation, and PBL methodology. Then they become familiar with the method by applying the ten PBL steps to some medical problems. Individual reading complements the discussions. During this period, experienced tutors foster and facilitate adaptation by acting as small-group facilitators. They answer questions, allay concerns, and, above all, demonstrate that the role of the teacher has changed. These workshops, which last a few hours, are repeated three times during preclinical training.

Other steps are taken to help students adapt to the Faculty. Each first-year student is paired with a second-year student serving as a "big brother" or "big sister". In addition, 25 teachers volunteer each year to mentor four students each. This special relationship aims at fostering student integration into the Faculty, providing information about professional life, ensuring early identification of students that may get into trouble, and, if needed, guiding them towards suitable help.

Table V. Training activities in the MD program

Preclinical Training		Weeks	Total
<b>First Year</b>			
1st semester <b>Phase I (4 months)</b>			
	Initiation to learning methods	2	
	Introduction to medical biology	11	
	Clinical immersion rotation	3	
2nd semester <b>Phase II (15 months)</b>			
	Growth-development-aging	4	
	Nervous system	5	
	Psychic sciences	4	
	Integration and evaluation	1	
	Musculoskeletal system	4	
	Community health sciences	4	
	Integration and evaluation	1	39
	Clinical skills*		
<b>Second Year</b>			
1st semester			
	Cardiovascular system	5	
	Respiratory system	5	
	Digestive system	4	
	Integration and evaluation	2	
	Clinical skills*		
2nd semester			
	Urinary system	4	
	Blood and immune system	4	
	Infectious disease	3	
	Integration and evaluation	1	
	PBL clerkship in the community	2	
	Endocrine system	3	
	Reproductive system	4	
	Integration and evaluation	1	39
	Human sexuality	1	
	Clinical skills*		
<b>Third Year</b>			
1st semester <b>Phase III (4 months)</b>			
	Multidisciplinary unit	14	
	Clinical skills*		
	Pre-clerkship*		16
	Ethics and medical law*		
	Interdisciplinary*		
	Integration and evaluation	2	
<b>Clinical Training: Clerkship</b>		<b>weeks</b>	<b>94</b>
<b>Third Year 2nd semester and Fourth Year (18 months)</b>			
	Regular rotations	42	
	Community rotations	12	
	Elective rotations	12	
	Preparation for examinations	5	
	Vacation	3	74
		<b>Total: 168 weeks</b>	

\* concurrent

*Introduction to medical biology*

The revolution in medical education put forward by Flexner (Flexner, 1990) at the beginning of the century was based primarily on the conviction that enlightened practice must be built on a sound foundation in the traditional basic medical sciences such as fine and gross anatomy, biochemistry, microbiology, and pathological anatomy. These subjects still make up most of what is taught during the first two years of medical education in most schools in North America. The material is taught according to the structure of these basic sciences. It is marked by research issues in these disciplines and often remains detached from the clinical problems that it is supposed to help solve. Furthermore, the relationship between these disciplines is often dynamic so that the actual boundaries between them are blurred. This is the case with molecular biology. In fact, there is a dwindling number of traditional anatomists and physiologists who teach these disciplines alongside clinical specialities.

Our goal was to merge basic and clinical sciences in order to add value to their relevance to medical practice and to use context teaching with them. This is one of the reasons that we opted for PBL as the learning system. Some outside consultants proposed total integration of instruction in the basic and clinical sciences. This would integrate basic-science teachers into PBL units of the systems type. While this objective was partially implemented in Phase-II units, we decided, at least initially, to devote eleven weeks in the first semester of the first year to teaching general concepts from traditional disciplines. Our decision was strategic: maintain the integrity of the preserve of fundamentalists; standardize the encoding of a common core of fundamental knowledge for students with heterogeneous premedical training; and prevent omissions, duplications, and difficulties related to certain basic concepts used in many units, such as muscular contraction and transmembrane transport of ions.

Students use PBL to acquire the basic concepts of cellular biology, biochemistry, physiology, pharmacology, and so on. Preparing this unit was a major challenge for fundamentalists. It consisted in translating knowledge into problems or phenomena and in explaining a limited number of fundamental concepts, principles, or notions for each of their disciplines. Integrating these disciplines through PBL problems proved difficult.

Our first effort at consolidating was merely a series of single-discipline subunits. The teaching of problems excessively emphasizes contents over reasoning and in-depth comprehension of major mechanisms. Neither does the lack of anchoring to realistic clinical situations lead to organization of acquired knowledge in long-term memory.

An assessment was carried out after three years. The fundamentalists finally worked in their unit committees to integrate the six disciplines involved. A few clinicians started working more closely with them to design more realistic PBL cases, making use of certain themes with a potential for integration, such as alcoholism and diabetes.

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In Phase I, students had about three hours of lectures a week in addition to three weekly tutorials. There were also labs for studying histology, microbiology, and biochemistry. A recent edition of the introductory unit on medical biology is more interesting. Its contents remain quite dense. Despite the fact that students in general do not find the unit very exciting, they seem to have a better grasp of the relevance of the scientific contents conveyed by the problems.

### *Clinical immersion rotation*

Early in December of the first year, the students leave the Faculty for a clinical immersion rotation. They are sent off in groups of two to six to non-university hospitals for a 3-week immersion in the real world of medicine. The issues in this experience are to provide students with a first-hand look at patients, the role of the physician, and the resources for delivering health care. This period emphasizes student autonomy through having the students set their own objectives and the means for achieving them. A flexible teaching framework aims at promoting individual reflections, interpersonal exchanges, and self-assessment.

**The course of the rotation.** During the first week, students serve mainly as nursing assistants in a department. They assist the nursing staff by one shame, clothing, feeding, and moving patients under their charge. This constant contact helps students establish communication with patients and their families. During the evening, students record their observations and reflections on the state of health of their patients, on the interventions of the health-care team, and on the doctor-patient relationship in logbooks.

Over the next two weeks, students accompany different physicians in the various hospital departments, outpatient clinic, operating suite, the laboratory, and the delivery room. They even do a 24-hour on-call stint at the emergency room. Students can also broaden their observations by accompanying physicians in private practice, in foster homes, in extended-care facilities, or on house calls. Students are free to structure their activities according to their own interests. The goal is clear. The experience is not to teach students about pathological conditions, but to allow them to benefit from sharing their observations on the roles of the physician and the problems encountered in professional life with practicing physicians.

**Teaching framework.** A physician from the host setting acts as a resource person to facilitate contact with health-care professionals there. In the Faculty, a teaching monitor takes responsibility for six to eight students, meeting with them before and after the rotation. If distance allows, the monitor visits them at least once during the rotation for a formal meeting.

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Throughout the immersion rotation, students keep an individual logbook in which they record their goals, achievements, and, above all, reflections on what happened during the day.

The experience makes an impression on them. They have observed, reflected on, and talked about the patient, medical life, and the preparation for their professional lives. Several years of experience have shown us that it finally gives students the chance to take a close and serious look at themselves with respect to their future profession.

## Phase 2: Sequence of PBL Units Based on Systems

Phase II stretches from January of the first year to the end of the second year. During this time, students work through 13 PBL units that last from three to five weeks each and which correspond to studying the various systems of the human body. In fact, the unit breakdown of the old curriculum has been maintained, but the total length of the units has been reduced by about 30%. Two new units have been added: *Growth-Development-Aging* and *Infectious Diseases*.

Throughout the Phase II and concurrently with the PBL units, students devoted a half day per week to practicing clinical skills, specifically physician-patient communication, taking medical histories, and performing physical examinations. A special effort was made to fit systems units and clinical skills (See Chapter 4) into the same calendar period.

A number of arguments weighed in favor of an organ-and-system approach for the preclinical phase of our program, which uses PBL almost exclusively as a teaching method. PBL has proved itself since the Case Western Reserve (Bussigel et al., 1988) experience. It responds to the Cartesian requirement of tying scientific research to the practice of medicine. It facilitates integration of knowledge and the practical aspects of medicine. Furthermore, it is the model most often selected for structuring reference books on the basic sciences (physiology) and clinical sciences (internal medicine), which are preferred tools for self-directed learning under PBL. Moreover, the organization required by the approach eases the integration of teachers who, although from different disciplines, share a professional interest in a specific organ or system. As an example, neurosurgeons, skeletal radiologists, rheumatologists, orthopedists, physiatrists, and pathologists are all interested in the musculoskeletal system.

The integration of basic and clinical sciences, using precise clinical prototypes that facilitate the construction of distinct schemas in long-term memory, must remain a major cognitive goal during the preclinical phase. The process is facilitated by breaking the contents down into systems and organs. On the other hand, if the goal is to train students to solve vague, general problems, such as are frequently encountered in primary-care medicine, then this design entails a number of disadvantages. Parcelling systems delays the acquisition of the knowledge needed for a comprehensive view of the patient's problems.

Segmenting the contents reassures students because it provides the boundaries and the specific objectives of the topic under study. On the other hand, it attenuates to a certain degree the expected cognitive benefits of PBL, such as the ability to apply the knowledge acquired to clinical situations presenting similarities or differences with the problems imposed by the program.

Nevertheless, strategic concerns led us to opt for a familiar model for organizing knowledge that the teachers would be more liable to accept along with PBL. In order to attenuate the negative effects on preclinical training, we developed a multidisciplinary problem integration unit, given during the third year, and a PBL rotation in a community setting, occurring in April of the second year. During this two-week stint in Quebec hospitals, students apply the method to real clinical problems. In this experience, which allows students to meet patients in a realistic community context promotes the integration of knowledge acquired in PBL and procedures learned throughout the clinical-skills unit. We added two units to the old curriculum: *Growth-Development-Aging* and *Infectious Diseases*. The first unit enables us to broach this study of the different ages of life in terms of their bio-psycho-social aspects. The unit deals with embryology, genetics, child psychological development, and problems of the elderly.

The unit on *Infectious Diseases* relates knowledge about many systems and organs of the body to their susceptibility to infection and to their response to infection. The four innovative concepts preferred to in the two preceding paragraphs reflect our insistence on periodically coming back to the concept of the human being as a whole and to encourage students to base their knowledge on it.

The learning problems presented are centered on analysis not on problem resolution. The task facing students in tutorials consists in explaining the phenomena described in the problems. Differential diagnosis and management are left to Phase III and the clerkship.

A typical week combines scheduled activities and periods of self-directed learning. Required activities include two half-day tutorials spaced two or three full days apart, a half-day devoted to learning clinical skills, a lecture, and, occasionally, a visit to a lab or lab work. Table VI depicts a typical week during the respiratory system unit (first semester in the second year).

Table VI. Typical week during the respiratory system unit

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.		Clinical Skills		9 a.m. - 10 a.m.  Lecture <i>Gas exchange</i>  10.30 a.m. - 11.30 a.m.  Consultation	Visit to the pulmonary function laboratory (depending on groups)
P.M.	1.30 p.m. - 4.30 p.m.  TUTORIAL			1.30p.m. - 4.30 p.m.  TUTORIAL	

Each unit begins with an introductory lesson that serves to start the unit off right. It also puts the unit’s position and contents into perspective with past and upcoming units so that students can see how it fits into the spiral structure of the program. The unit director and his/her colleagues describe the unit, the level of analysis expected from students, and the degree of depth sought in the basic and clinical sciences. Reference books and other teaching resources are critiqued. Students are given the specifics about the written formative evaluation.

Problems are presented twice a week during Phase II in three-hour tutorials. The first part of the tutorial focuses on discussion of the previous week’s problem after students have had the time to consider it during individual study. It ends with a summary of group work and dynamics. The second part of the tutorial is used to analyze a new problem. This means that only eight problems can be dealt with in a four-week unit. PBL groups comprise eight students; the groups are randomly formed for each unit. Half of the tutors are not experts in the specific topic or field covered in the unit. On the other hand, more than 80% are physicians and many of them -as well as the fundamentalists- have a relatively sound grasp of unit contents, depending on their particular fields of interest in research or clinical practice. We feel that all tutors must know the field well enough to make interesting interventions and to sustain motivation.

One might wonder about tutor background. The nervous-system unit gives a fairly representative answer: four neurologists, two neurosurgeons, a neuropathologist (unit head), a neuropsychiatrist, two physiologists, two internists, and a family physician. Few units have tutors who are specialists in the discipline, as is the case in psychological science. Others, such as the unit on the respiratory system, have very few.

Large group presentations take up only one or two hours per week. They are of two types. First, the traditional lecture -generally given at the start of the unit- usually provides an overview of the fine and gross anatomy of the system in question. These sessions provide a good opportunity for students to get generally acquainted with the topic. Topic summaries then allow students to question the teacher about difficult subjects that were covered in a tutorial or encountered during individual study. While students appreciate the material being presented from a clinical standpoint, they often balk at the sessions being used to pass on additional material.

Integrating the traditional teaching of the basic sciences with clinical sciences has considerably reduced the number of hours of laboratory work in the new program. Some sessions have been maintained in biochemistry, microbiology, histology, and anatomy/dissection. In certain units, students are asked to examine dissected specimens in groups prior to material being presented on specific anatomical regions (thorax, abdomen, upper limbs, and so on). They prepare for these sessions through self-directed learning modules. For hematology, the cytology laboratory is used to broach complementary problems in small groups under the supervision of the tutor.

Students also take guided tours of clinical laboratories in small groups when studying problems in the areas of neurology, cardiology, pneumology, and gastroenterology. Students are not expected to master investigative methods and techniques, rather this is an opportunity to provide a stimulating environment in which they can develop a desire to learn about physiological mechanisms and, above all, demonstrate their clinical applications.

In short, even if PBL drives the educational system during Phase II, the unit designers must be very inventive in complementing it with additional teaching resources in order to create a motivating atmosphere, more clearly demonstrate their relevance of the subject, enrich the material to be studied, and increase the applicability of the knowledge acquired.

The unit committee has the task of setting learning objectives that all tutors share and know and which will be recorded in the *Tutor Guide* (Chapter 3). Students adopt them during step 5 of the tutorial. The planned learning objectives and those resulting from the analysis of a PBL problem become topics for self-directed learning between the two sessions for studying a particular problem, which means between two tutorials. In this respect, the educational system is deemed directive.

The *Student Handbook* contains a list of references for each unit. The references are annotated in the handbook or commented on during the unit introductory lesson. Mandatory and optional references are listed for each unit. Students use their own books, such as Harrison (Isselbacker, 1994), Guyton (Guyton, 1991), and Robins (Cotron et al., 1989), in working towards more than 80% of their study objectives. Additional information can be obtained, if necessary, from the health sciences library.

Students do formative self-assessment exercises, in the form of written questions, in each of the units. The questions are similar to those used in quarterly written summative examinations: multiple-choice, open answer, short answer, or problem analysis. They cover about 80% of the learning objectives. Each question is followed by the correct answer and an explanation to ensure comprehension. These exercises allow students to assess their own progress and to familiarize themselves with the different types of written exam questions that have been adapted to the specific contents of the PBL units. The questions are designed to facilitate the self-assessment process for students. Some teachers tend to use these questions to introduce supplementary objectives. Although the exams are seen as complementary to individual study, some questions are occasionally discussed during tutorials or in large group classes.

The schedule allows time for students to talk one-on-one with specialists on topics that are difficult or ambiguous, especially in cases in which the tutor is not an expert on the matter. Students, however, rarely take advantage of these occasions; they seem to prefer discussing their concerns with their tutors either before or after a tutorial, or talking the matter over with students in other groups or from other years.

### *Learning clinical skills*

The clinical skills unit runs concurrently with PBL units throughout Phases II and III in what represents a major transformation of activities for learning clinical skills. The sessions last a half-day per week from January in the first year until the start of the clerkship. The unit is divided into four semester-long steps (Chapter 4). The major components are provided below. During steps I and II, half of the sessions deal with communication techniques and humanistic attitudes to be developed in patient-physician relations. Each three-hour session deals with a theme such as nonverbal communication. Students work in small groups of eight with a clinical monitor. The other half of the sessions, which alternate with those on communication, teach students how to take patient histories and carry out physical examinations. This part of the unit is integrated into the study of the clinical sciences pertaining to a system or organ, depending on the sequence of PBL units.

During steps III and IV, students tackle specific situations such as palliative care and the interdisciplinary approach to geriatrics under the supervision of clinicians serving as role models. Starting in January of the first year, students set about building an overall assessment of a patient and presenting a case history complete with physical examination and diagnosis. In the third year, students discuss differential diagnosis and develop an investigative plan.

Chapter 5 presents a detailed look at student evaluation. Psychomotor skills and attitudes are assessed at the end of each step by way of a written exam and an objective structured clinical examination (OSCE).

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*PBL rotation in a community setting*

In April, second-year students leave the Faculty for a two-week rotation in non-university hospitals delivering secondary care. Students are divided into groups of four apply the PBL method to actual patients.

The student takes the medical history of the assigned patient and begins the exam, recording medical observations and making a preliminary list of problems. A peer observes the process and makes notes of his/her observations on a grid to provide descriptive feedback on the student's skills and attitudes. Each medical observation is presented to the group and analyzed according to the PBL process. The group draws up a preliminary list of problems and suggests an approach. The hypotheses give rise to a series of questions that serve as study objectives. The approach to the patient is comprehensive and takes into account biological, psychological, family, and social considerations as well as preventive measures. Each student seeks out references and studies the topics identified as learning objectives. Back in their groups, students take up the analysis again, revise their hypotheses, improve the list of problems, and plan an approach. New questions requiring study may crop up. The session ends with a group assessment and an individual assessment. The student who was responsible for the patient gives the Faculty monitor the preliminary and definitive lists of hypotheses, problems, and approaches developed by the group.

This activity strengthens the community character of the program and can be seen as maintaining continuity with the clinical immersion rotation in the first year and the 12-week community-health clerkship. The session compels students to grasp the relevance of what they are learning, to assess their degree of autonomy, and to increase their motivation.

The physician serving as resource person facilitates reception, ensures access to the library and a meeting room, and stimulates group motivation. The physician presents one patient a day to the students, ideally two the first day, including one with multidisciplinary problems. The patient's chart is only available if the physician deems it appropriate at the end of the process. Since students must exercise their autonomy, the local physician is relieved of teaching and evaluation responsibilities. On the other hand, any remarks from the host institution pointing out problems that a student may have in terms of behavior or attitude are taken very seriously by those in charge of the rotation.

The *Student Handbook* describes the tasks of students and the role of the physician serving as a resource person in the host institution. Students are evaluated on a pass/fail basis. The evaluation is based on analysis of the *logbook* that each student must hand in to the unit leader.

Organizing this kind of session for 100 students requires a great deal of energy at the outset, but less later on. Student enthusiasm, participation, and satisfaction are the reward.

Students have to demonstrate initiative in organizing their daily lives, generally in unfamiliar surroundings and often in regions far from major urban centers. They find the experience enriching and the quality of their logbooks shows it. The diversity of clinical problems encountered is impressive. In a short lapse of time, students have to face a variety of new situations. We can count on the co-operation of hospitals, which have demonstrated a great deal of openness towards teaching based on student autonomy.

#### *Course on human sexuality*

The second year ends with a week-long course on human sexuality. The first two days of the week are devoted to lectures in the Faculty, and followed by studying texts on subjects such as the physiology of the sexual response, sexual dysfunctions, and abnormal behavior. The remaining five days are spent as a workshop in a vacation resort. Sexologists facilitate discussions with students in mixed groups of eight to ten people. They talk about ten themes, basing their discussions on texts, audiovisual material, testimonies, small group discussions, and plenary sessions. Eroticism, masturbation, violence, and homosexuality are some of the topics discussed.

This teaching activity has been offered by the Faculty since 1976. The format of this course, which is centered on the student and meets the criteria for the new program, has not been modified. After 15 years, the assessment shows that this week-long activity has a positive impact on student personal growth and socialization, in addition to enabling students to reach certain specific learning objectives.

### Phase 3: Integration and Preparation for the Clerkship

Phase III, covering September to December in the third year, serves as a period of integration and immediate preparation for the clerkship. Four activities run concurrently during the semester: a multidisciplinary PBL unit involving complex problems; step IV of the clinical skills unit, whose objective is to promote a comprehensive approach to the patient; interdisciplinary experience; and activities in preparation for the clerkship stressing the acquisition of different techniques used in clinics and discussions about legal and ethical issues arising from the practice of medicine.

#### *Multidisciplinary problem integration unit*

The multidisciplinary problem integration unit does not target the same objectives as the preceding PBL units. While the problems presented help recap the knowledge acquired from the beginning of the program, we want, in particular, to integrate it. The multidisciplinary problem integration unit aims at broadening the knowledge base of students by adding new dimensions to clinical problems, differential diagnosis, paraclinical investigation, and management. Lastly, the unit allows us to cover a certain number of common clinical problems that are not dealt with elsewhere.

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*A new type of problem*

A new series of twelve problems has been created to help students achieve these goals. These problems are longer and more complex than those used during Phases I and II. They illustrate clinical syndromes involving a number of organs and systems of the human body concurrently and sequentially. An example would be metastatic breast cancer associated with subacute bacterial endocarditis. These problems are presented sequentially and recurrently, with stations being imposed on students as a self-directed learning module. Table VII provides the list of problems offered to students during the multidisciplinary integration unit.

As they evolve, these problems involve delays in investigation and treatment during which complications may occur. They share features with actual clinical situations because they have been inspired by the files of patients who have been treated by unit teachers.

The problems were selected as teaching and integration prototypes, not as problems that would be typically encountered in the average medical career. While the designers do not expect the average student to manage such situations, students should be able to explain the main mechanisms involved. Problem solving learning (PSL) establishes a new range of goals, as illustrated in Table VIII.

*Cognitive benefits of the multidisciplinary problem integration unit*

There are, of course, cognitive differences between the problem solving carried out by the physician in the course of daily practice and that used by students during the multidisciplinary problem integration unit. A physician must analyze and account for the various clinical problems observed in the patient. In practice, these problems may be isolated, multiple, and unrelated physiopathologically, or multiple and interrelated in a complex manner. They may be relatively well-defined or structured.

On the other hand, the problems presented during the multidisciplinary integration unit are multiple, interrelated, well-defined, and structured. Students, just like a physician in a similar situation, must make an effort to explain the problems based on analysis. Therefore, it is a problem-solving activity that draws its legitimacy from the complexity of the problem. Nevertheless, it remains an explanatory analysis activity similar to that experienced by the students in preceding phases, but on a different level.

Moreover, a clinician must make associated investigative and treatment decisions: that is the ultimate goal of practicing medicine. This decision-making process constitutes the resolution of a real problem based on medical competence. During the multidisciplinary problem integration unit, students must be able to analyze, understand, and explain the decisions that have already been made by those who designed the problem. Students must also be able to assess the outcomes of the investigation and treatment described in the problem statement.

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Table VII. The twelve problems in the multidisciplinary integration unit

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1.    **Pediatric Development**  
Multifactorial delay in psychomotor development
  2.    **Inflammatory**  
Chronic celiac disease with malabsorption
  3.    **Metabolic**  
Diabetic ketoacidosis with marked hyperlipidemia
  4.    **Traumatic**  
Head, abdominothoracic, and bone multitrauma
  5.    **Degenerative**  
Evolution of multiple sclerosis from the onset until hospitalization in a chronic-care institution
  6.    **Iatrogenic Environment**  
Immobilization syndrome in an elderly person following highly complicated surgery (hospitalization lasting one year)
  7.    **Infectious**  
Acute bacterial endocarditis with multiple complications (valve rupture, ruptured mycotic cerebral aneurysm, glomerulonephritis with immune complexes)
  8.    **Vascular**  
Unstable angina following aneurysmectomy of the abdominal aorta, progressing toward infarct and cardiogenic shock
  9.    **Psychosocial**  
Chronic alcoholism and its complications
  10.   **Immunological**  
Rhumatoid arthritis complicated by pericardial and pulmonary damage as well as rhumatoid vasculitis
  11.   **Oncology I**  
Childhood acute lymphoblastic leukemia
  12.   **Oncology II**  
Evolution of breast cancer from onset until death hypercalcemia, bone metastases, pleural effusion, etc.
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In real terms, it is the extension of an analysis process to clinical decision-making. Students, concerned with formulate hypotheses and anticipating later steps before reading the rest of the problem, can undertake a more in-depth, purely cognitive study leading to the resolution of medical problems. In doing so, they frame the learning process within a perspective of prospective intervention.

Table VIII. The goals of problem solving learning (PSL)

Problem solving learning (PSL)

- Greater application of basic science in explaining clinical situations.
- Learning to solve problems through the discussion of the principles of investigation and management
- Acquisition of new concepts in fields receiving less focus (oncology, pharmacology, alcoholism).
- Knowledge about all phases of human life, from infancy to old age.
- Demonstration of greater critical thinking due to discussions on diagnostic probabilities, sensitivity, specificity, and cost-benefits of preventive, diagnostic, therapeutic, or rehabilitative intervention.
- Efficient information research, including the use of computerized databases.
- Updating the comprehensive and interprofessional approach in problem situations.

*A tutorial in phase III*

In order to achieve third-year objectives relating to the development of autonomy, the PBL method was modified to emphasize self-directed learning.

Students receive the problem to be studied at the end of the single weekly PBL tutorial session, which is on Friday. Over the week until the next small group session, each student analyzes the problem individually, by sequence, in order to account for the phenomena, identify topics for study, find information in textbooks, and prepare an assessment for the next discussion.

Students then meet in groups of eight for three hours in what is the only tutorial of the week. A randomly selected student initiates the discussion with an organized presentation of his/her interpretation of the situations described in the problem statement. After a set time, his/

her peers have the opportunity to point out ambiguities or offer other hypotheses. The process continues, each student getting a turn so that the problem is analyzed and solved.

Each student must prepare a written diagram of the physiopathologic interactions caused by the problem. The diagram is handed in to the tutor, who corrects it and makes relevant comments.

The tutor, now referred to as a mentor, plays a very active role. The mentor leads the session, unlike during the preceding two years, when the student did. The mentor's role is to question students and to push them to deepen their clinical reasoning. The mentor must be both skilled in the process and an expert in the topic.

Mentors are recruited from among experienced clinicians from the Department of Medicine and also from pediatricians during the two weeks devoted to problems in this specialty. Two mentors team-teach a group of eight students for a period of four months. They also supervise the activities in the clinical skills unit scheduled for their students during the semester.

**Student preparation.** Students face a demanding workload and must demonstrate greater autonomy in managing their learning. The process is also different because students embark on clinical reasoning. The first week of the unit deals with the problem-solving process. Each student must read the first section of Paul Cutler's book *Problem Solving in Clinical Medicine* (Cutler, 1985). Then, under the supervision of their mentors, students in small-group sessions share their understanding of principles and mechanisms for solving the problem. They also infer the consequences of the approach -individual and in tutorials- of problems in Phase III.

### *Pre-clerkship*

Lasting for 14 weeks in the first semester of the third year, the pre-clerkship gives students opportunities to participate in activities that develop the knowledge needed to practice medical/surgical skills, use radiology laboratories and medical records, conduct literature searches, and practice interdisciplinarity.

Guided by protocols or video demonstrations, students train on manikins or peers to master certain medical/surgical techniques. The monitor observes student dexterity and corrects technique as required.

The ten procedures and techniques taught include sterile technique, surgical dress and scrub, installing an IV drip, wound closure, and nasogastric intubation. Real patients are not treated until the actual clerkship.

Moreover, students put three hours into laboratory use even though this topic is also discussed during the multidisciplinary integration unit: which tests should be ordered, in what sequence, should they be carried out urgently, how should they be prescribed, how

should the results be interpreted, when to become worried. The activity ends with a cost-benefit analysis of analysis prescription.

X-rays are occasionally used during Phases I, II, and III in discussing certain problems. They are also used in applying information about surface anatomy in learning how to give a physical examination. Furthermore, the clerkship includes a series of mandatory objectives that deal with the interpretation of normal and abnormal X-rays of different organs and anatomical regions. Two examples of this are the flat plate of the abdomen used in surgery and radiography of the sinuses in pediatrics. Students have access at all times to a series of self-directed learning modules organized by organs and systems in the radiology department of the university hospital. The pre-clerkship, on the other hand, provides the opportunity for a more structured initiation to radiology. Two 3-hour sessions are devoted to the general principles of radiology, its use in investigating clinical problems, and the construction of algorithms for prescribing radiological exams by students.

We also take advantage of the pre-clerkship to familiarize students with using medical files. We touch on both the computerized files developed in recent years at the university hospital as well as the complementary paper files.

Students must also learn to write up observations based on the problem-structured file model and manage the patient using the SOAP (subjective, objective, analysis, and plan) sequence. The success of this on the medium term is limited by the fact that many clinical teachers do not make use of this model in their daily work.

When they are admitted to the Faculty, students are given an initiation on how to use the library. Toward the end of the first year, the step-by-step approach in critically analyzing an article is presented during the unit on community health sciences. Only when the students enter the pre-clerkship are they required to carry out a literature search using computerized data banks. Into sessions, they learn how to query the library's computerized files and the Medline system, a North American data bank on CD-ROM. Instruction ends with a mandatory literature-search test.

Should students to be taught earlier how to use data banks? During the first 30 months, students work mainly with their books and monographs. They only start using journal articles on a more regular basis during the clerkship where they could be used in treating patients seen in clinics. We are not convinced that earlier introduction would be as useful considering that it would not respond to any real needs and would not be supported by regular practice.

### *Ethics and medical law*

The problems that physicians must face go beyond strictly of biomedical issues. Medical decisions also involve ethical, legal, and social considerations. Students need to become familiar with the tools that will allow them to take these aspects into consideration.

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At the outset to the reform, we required that each PBL problem have an ethical and humanistic component. Nevertheless, students as well as tutors had tended to focus almost exclusively on the biological aspect. They did not see ethical questions as being study objectives. In 1991, we adopted another strategy. We no longer tolerated hit-or-miss ethical or humanistic objectives. From then on, each unit had to identify a specific problem in its topic area and set aside a session for discussing it.

But properly discussing the ethical issues of a problem requires theoretical grounding and the opinion of specialists. Prior to discussions, therefore, students have to do appropriate reading. The members of the Faculty's group of ethical experts serve as consultants to the leaders of PBL units. Some of the themes currently dealt with are prenatal diagnosis during the growth-development-aging unit and the termination of treatment and resuscitation during the units on neurology and the cardiovascular system.

In addition, Phase III includes 15 hours devoted to ethics and medical law. Three-hour sessions are alternated with other pre-clerkship activities dealing with different themes, such as medical liability, informed consent, and representatives for incapacitated persons.

### *Interdisciplinarity*

One of the three essential program goals is to develop a sincere concern for community-health problems. Students must make the most of the range of expertise in the health-care network. This means preparing students to work harmoniously and efficiently with health-care professionals in order to respond to the patient's overall needs. In fact, striving to achieve this objective is the reason underlying the activities related to interdisciplinarity. Its achievement is premised on mastery of a certain number of specific objectives at three levels. To illustrate, on the level of knowledge, students must know what type of expertise can be provided by a social worker or an occupational therapist. In terms of attitude, students must be able to identify their perceptions and prejudices with respect to other professionals. As for know-how, students must be able to identify and communicate their field of expertise and type of co-operation that they can contribute. The entire period of training -both undergraduate and graduate- is not too long a time for students to achieve these objectives.

As with autonomy and humanism -two significant and complex goals of the MD program- we strive to take advantage of two major strategies for implementing interdisciplinarity. First of all, we exploit the potential of existing activities even if, for the most part, they were designed to serve other needs. We try to add these complementary objectives to them whenever their context and contents make it attractive. In addition, we believe that learning activities focusing on teaching interdisciplinarity must be developed. We ran into a number of difficulties in doing this as noted in Chapter 6.

Interdisciplinarity is a complementary objective during the three-week clinical immersion during the first year. Students must observe the interactions between patients, physicians,

nurses, and other health-care professionals. They must then record their observations in their logbooks and use them to draft their reports on the immersion rotation.

The PBL community rotation during the second year provides students with an opportunity for identifying, in small groups, interdisciplinary intervention objectives in patients that they have been asked to evaluate. In the longitudinal clinical-skills unit, students receive an introduction to the interdisciplinary approaches used by the palliative-care team in managing patients in the advanced stages of cancer.

As a main learning objective, interdisciplinarity is taught formally during the first semester of the third year. The course makes use of a highly structured interdisciplinary approach used in a Faculty-affiliated geriatric institution. Under the supervision of a geriatric monitor, students in small groups are called on to evaluate the overall needs of an elderly person admitted for a checkup, to take part in the discussions with various medical and paramedical specialists in order to develop an appropriate intervention plan. Although it is brief, students appreciate this activity because it is a realistic, complete task in itself.

An interdisciplinary committee for the MD program is currently working to flesh out and more firmly implant this collegial aspect of health care throughout the entire program, since it will play an increasingly greater role in the years to come.

## Programme Administrative Structure

Planning and implementing program reform is just one step. The program must be administered so that it develops. What kind of administrative structure would enhance achievement of the goals of the reform and ensure constant improvement of the program? How should we organize our structures governing operations, initiative, and authority? Since it was designed as a Faculty project, the new program was launched under the captainship of a new vice-dean education, with the unflagging support of a new program director. These two individuals devoted two years to start up the preclinical phases and arouse interest in reforming the clerkship. Although originally spearheaded and directed by a small core of innovators, the reform project picked up new committed supporters with each passing unit. As it developed, the project was gradually "handed back" to its real leaders, who were close to the action. The vice-dean gradually stepped back as part of the strategy. The program director established administrative procedures that enabled everyone to assume their responsibilities and demonstrate their initiative while still being held accountable for their action. We wanted to remain somewhat "orthodox" with respect to the initial project in order to prevent problems encountered during the start-up period from pushing us off course. It was not long before everyone was caught up in the atmosphere of this major Faculty undertaking.

By 1990, after repeated adjustments, the administrative structure had gelled into a stable unit (Fig. 2)

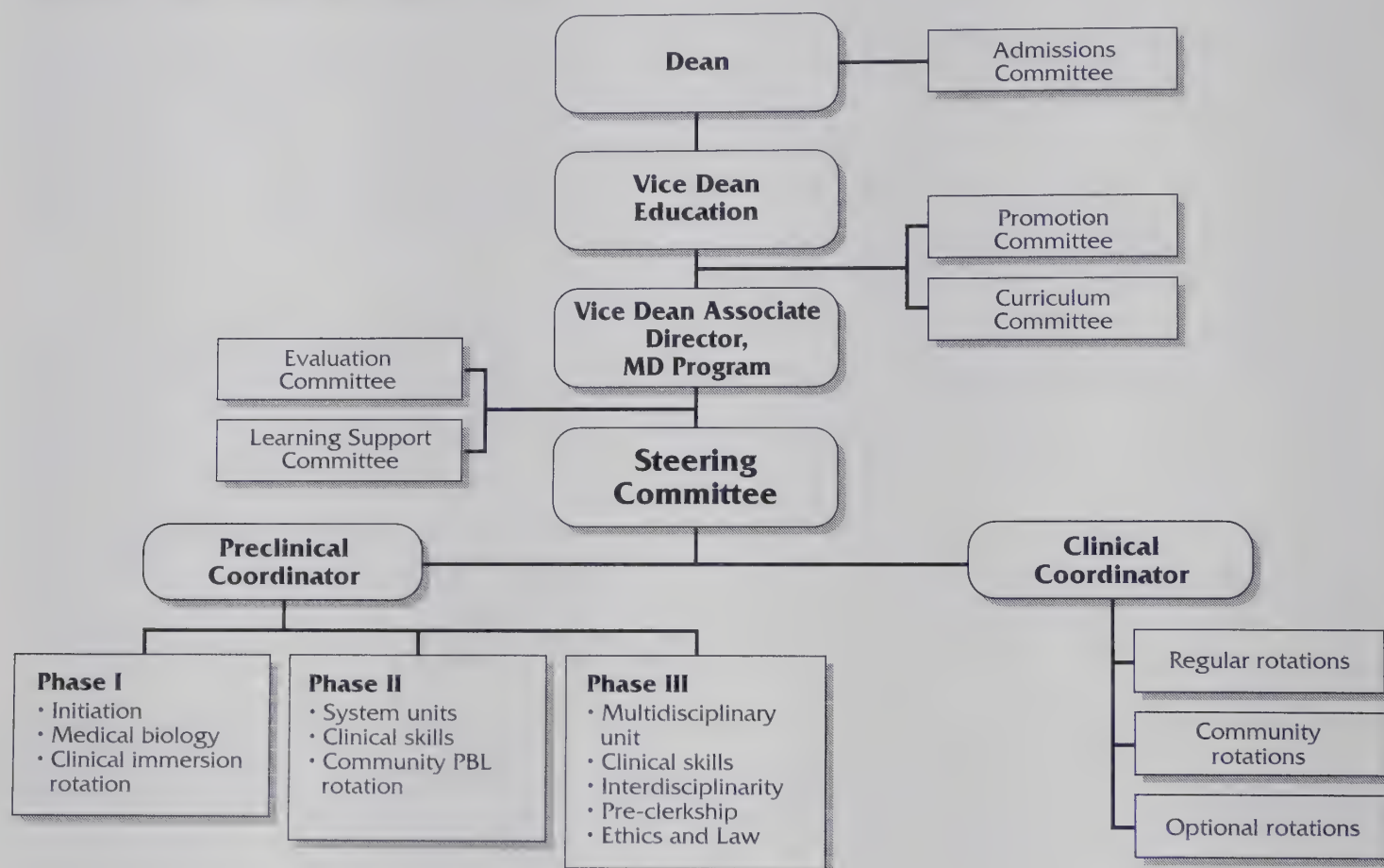


Figure 2. The MD program administrative structure

### *Academic vice-dean*

As is commonly the case throughout North America, the major divisions in our Faculty - education, research, professional affairs- are headed up by a vice-dean. As the leader of the Faculty's teaching mission, the vice-dean education at Sherbrooke is responsible for all undergraduate programs. In his/her role as immediate superior to the heads of the six undergraduate programs in health sciences, including the bachelor of nursing and biochemistry, the vice-dean education answers to the dean and the Faculty Council on matters pertaining to the MD program as well as postgraduate medical-education training programs (residency in family medicine and 27 specialties). Each program director serves as a member of the Academic vice-dean's Education Council. The Medical Education Center, which provides support staff and directs research activities, also comes under his/her purview, as well as the Center for Continuing Medical Education.

### *Managing the MD program*

At first glance, the administrative structure of the MD program appears conventional. Table III provides a clearer understanding of how it works by presenting resources and tasks. The resource component breaks down into departments. Each department has its own head and is structured to provide clinical services and to engage in research activities.

The tasks and functions relating to the MD program come under the other component. In fact, the MD program is largely independent of disciplines and departments. As a consequence, program administration is centralized and autonomous; it operates with its own specific budget. Tasks and functions are assumed entirely by the people in charge (appointed by the program director) and various committees. Those responsible for the program call on the departments to provide teaching resources. A reward system has been set up in the Faculty to reimburse departments for services provided by their staff. The system is similar to the model used by the provincial government to remunerate for clinical services.

PBL unit management structure showing department resources

Departments	PBL* units		
	Locomotor system	Digestif system	Hémato-immunologic system
Physiatrics	☆☆		
Neurology		☆	
Orthopedic surgery	☆☆☆☆		
Rhumatology	☆☆☆☆☆		
Internal medicine			☆
Pathology	☆	☆☆	☆
General surgery		☆☆☆☆	☆
Obstetrics & Gynecology			☆
Neurosurgery	☆		
Anatomy and cellular biology	☆	☆☆	☆
Family medicine	☆☆	☆	☆
Gastroenterology		☆☆☆☆	☆
Pediatrics		☆☆	☆☆☆
Hematology			☆☆☆☆☆

☆ = PBL tutors      \*PBL = problem-based learning

Figure 3. PBL\* unit management structure showing department resources

Associate vice-dean for the MD program

The associate vice-dean education is responsible for planning, implementing, managing, and evaluating the MD program and its components. He is the de facto program director. Since the vice-dean education was mandated to implement the reform, they had to work very closely during the initial years. In order to better fulfill his role, the associate vice-dean is assisted by a preclinical coordinator, a clerkship coordinator, and multidisciplinary committees.

*Preclinical coordinator*

The Preclinical Coordinator is responsible for carrying out activities, facilitating, advising unit heads, and providing student guidance. His or her main tasks are ensuring that teaching and student evaluation activities mesh and are carried out smoothly; supervising, facilitating, and advising unit heads; serving as a student adviser, especially to those with academic problems; and ensuring the evaluation of the various activities.

*PBL unit head*

Each of the PBL units was originally developed by a multidisciplinary team of five or six people who had to define the list of concepts or specific objectives, build PBL problems, devise formative and summative evaluation, recommend references, and draft the *Tutor Guide*. As they stand today, PBL unit groups are still multidisciplinary but they only have three or four members and their mandates are more specific (See Table IX).

Table IX. Mandate of a PBL unit group

- 
- Draft the calendar of activities and the *Student Handbook*.
  - Fine-tune existing problems and build new ones.
  - Complete formative-evaluation exercises.
  - Update the *Tutor Handbook* and references.
  - Design the summative exam and ensure its correction.
  - Recruit tutors and take part in their training.
  - Develop strategies for strengthening tutor and students interest.
  - Integrate the students responsible for the unit.
  - Draft an annual assessment.
- 

*Clerkship coordinator*

The coordinator for the clinical phase assumes responsibility for the 18-month-long clerkship. He or she ensures that student assignments take into account the resources in the host institutions and teaching objectives (which he or she is responsible for updating). His or her tasks relate to organization of clerkship rotations, controlling the quality of training, evaluating learning, and screening for students with difficulties. He or she serves as a guidance counselor for students during their clerkships and provides ongoing assessment of clerkship quality. He or she receives assistance from supervisors for the various clerkship rotations (medicine, surgery, pediatrics, psychiatry, gynecology-obstetrics, family medicine, and community health). The individuals with whom the coordinator works directly play a determining role in the quality of the clerkships, especially if they receive sound support from department heads. The Clerkship Coordinator chairs the monthly meetings of the Clerkship Committee, whose membership includes rotation supervisors.

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*Clerkship rotation supervisors*

The associate vice-dean appoints faculty members as clerkship rotation supervisors from their respective disciplines upon recommendation by the clerkship coordinator and the program director. As a member of the Clerkship Committee, clerkship rotation supervisors come under the Clerkship Coordinator and have a specific mandate (See Table X).

Table X. Mandate of clerkship rotation supervisors

- Update the list of mandatory objectives for the discipline and ensure that it is used by students in their clerkships and teachers.
- Coordinate available clinical resources in order to optimize an appropriate framework and maximize clinical contacts for students.
- Organize an orientation session at the beginning of the rotation and during the feedback meeting at mid-clerkship.
- Coordinate the learning sessions with clinical reasoning.
- Ensure with supervisor cooperation that the clerkship evaluation forms are uniformly completed and that they contain descriptive feedback.
- Organize the sitting of an OSCE-type final exam.
- Conduct, with the cooperation of the department heads and colleagues, periodic evaluation of clerkship quality taking into account the evaluation provided by the students in their clerkships.

*Coordination committee*

The Coordination Committee brings together the main individuals responsible for the program (See Fig. 2), specifically, the Preclinical Coordinator, the Clerkship Coordinator, clinical-skills and Phase-III supervisors, the chair of the Evaluation Committee, the administrative assistant, and the academic vice-dean. Under the leadership of the program director, the committee coordinates the day-to-day management of the program (See Table XI).

The committee meets for three hours each month. Its decisions are directed to those individuals in charge of the different sectors. The Committee also makes more general recommendations to the academic vice-dean.

*Promotion committee*

The Promotion Committee judges student performance once all grades have been submitted (See Chapter 5). The committee is comprised of five teachers (one of which serving as chair), the vice-deans, and the Faculty secretary. Program directors are invited to sit as nonvoting resource persons. The five teachers do not serve on other committees related to program management. Based on the student's complete file, the Committee recommends to the Faculty Council that the student be promoted, repeat certain activities,

repeat the entire year, or be dropped from the program. The Committee's recommendations often include provisions such as assigning an advisor to the student.

Table XI. Responsibilities of the coordination committee

- 
- Coordinate phases, units, and clerkship rotations in order to ensure a continuum of learning activities, from preclinical to clinical training, in accordance with the concept of spirally learning.
  - Coordinate resource use.
  - Foster the sharing of skills and cooperation between different sectors.
  - Monitor how activity unfold and suggest strategies that facilitate learning and foster motivation.
  - Maintain teacher enthusiasm and suggest strategies that promote teaching training.
  - Submit an annual assessment of activities that highlights program strengths and weaknesses; suggest strategies and modifications for the following year.
- 

#### *Program committee*

During the intensive development period of the program (1986 to 1990), a particularly eclectic multidisciplinary group functioned as a validation committee. Its members were the academic vice-dean, the Program Director, the Director of the Office of Educational Development, the Preclinical Coordinator, the future head of the multidisciplinary unit, and a fundamentalist. This group reviewed all the teaching material to ensure its relevance to program goals, compliance with the PBL method, suitability with respect to student level, and fit with other units. It monitors, throughout the phases of training, compliance with a philosophy that advocates cumulative and spiral learning (progressive and increasingly broad). The group accomplishes a significant amount of supervisory and advisory work.

In 1990, a formal program committee took over, assuming responsibility for carrying out overall program evaluation, making recommendations, suggesting corrective actions, and fostering innovation. It advises the academic vice-dean, with its opinions then being sent on to the Office of the dean and the Faculty Council, for implementation by the Steering Committee.

#### *Evaluation committee*

In its role of controlling examination quality, the Evaluation Committee ensures that all evaluation policies and regulations adopted by the Faculty Council are strictly adhered to. It analyzes examination results and ensures that they conform to standards. The committee guarantees examination quality in terms of reliability and validity. Consequently, the committee monitors quality of measurement without passing judgement on promotions. This approach has become part of our way of doing things.

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*Learning support group*

For more than 15 years, the Faculty has offered students the opportunity to consult a psychiatrist should emotional problems arise. All records pertaining to such consultations are confidential and treated as privileged communications. The close contact between tutor and students in a PBL program makes it easier to quickly and specifically detect problems in areas such as learning, analysis, and communication. A support group provides appropriate remedial assistance.

*Matrix administrative structure*

The program administrative structure alone is responsible for activity format and objectives. It calls on department resources in carrying out its tasks. We feel that this dual structure is essential to achieving the program's main goals as well as to ensuring coherency within and between activities. Indeed, undergraduate training aims at providing students with the means to integrate knowledge from various disciplines in solving a clinical problem. Students must approach knowledge comprehensively and arrange it in their memories according to interdisciplinary links. In addition to acquiring sound scientific grounding, students must begin developing specific skills and attitudes from the outset. A conventional faculty structure, based on a department or discipline approach to contents, would make achieving these objectives difficult. Furthermore, chances are that anyone in charge tied to a specific discipline would have a skewed perspective. Despite the tensions that it tends to generate, a matrix structure alone can yield sound teaching compromises among the subject matters.

Program management therefore uses a matrix structure for two main reasons. Firstly, to counterbalance the inherent strength of departments through the clustering of faculty members with shared or similar scientific interests, discipline-based health-care delivery, common use of specialized technology, and a natural tendency to a new generation of specialists in the same field. Secondly, in order to assign tasks based on objectives set by consensus rather than according to tradition within disciplines. Fortunately for us, this dual structure has worked very smoothly since the Faculty's creation in 1961.

## Conclusion

This is how our program looks seven years after implementation. Three specific orientations guide teaching activities so that Sherbrooke graduates acquire greater autonomy in learning, an interest in community health issues that shows up in their practice of medicine, and the ability to respond humanistically in their professional lives. We have never questioned our initial choices. Quite to the contrary, they continue to be confirmed by new international trends in medical education.

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We have opted for Problem-based Learning to offer a program centered on students and to promote greater autonomy in learning. As a result, we have constructed three PBL patterns that allow application of the method at different levels of training. Although its theoretical basis is modest, this initiative, inspired by our praxis, has been validated by developments occurring in other faculties (See Chapter 13).

To better instill in students real concern for community problems, we have them go out into non-university hospitals and health-care centers in the province for training. They also benefit from a continuum starting as clinical immersion and a community PBL rotation in the first and second years, followed by rotations in community health, family medicine, and acute primary care during the clerkship. For the present, we cannot offer a program that is more deeply rooted in the community.

To better prepare students to practice medicine focused on patients, students take part in a longitudinal clinical-skills program starting in the first year. This program stresses communication and the patient-physician relationship as well as the concepts and attitudes of medical humanism, which are current requirements in North American society.

We have already come a fair distance. Nevertheless, the Program Committee wants us to go farther and is showing us action plans to move us towards the main goals of our educational reform (See Chapter 13).

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## Problem-Based Learning: The Vehicle for the Educational Reform

Bertrand Dumais and Jacques E. Des Marchais

*Take care of what is difficult  
while it is still easy  
and deal with what will become big  
while it is still small  
- Lao Tsu*

### Introduction

The scene: eight students involved in a discussion. Some are talking, others listening, but all seem to be paying attention to what is going on. One of them is taking notes at the blackboard; another is directing group work. An older person whose role seems less active appears to have some kind of influence. The students react to his nonverbal messages. Perhaps a teacher...but he is not "teaching". Nevertheless, his questions help the group make progress.

The group is discussing a medical problem that was broached during their last encounter. They are trying to define the problem, understand its underlying mechanisms, and account for them. At the end of the session, the students, satisfied with their work, go their separate ways but each has his or her own planned personal study plan. Two days later, the group members will take up the analysis where they left off, but with much more assurance and in greater depth. The older individual -the tutor- adroitly invites the students to clarify things and to add to their inventory of questions and explanations. During the time between the two group meetings, each of the students has worked hard to answer his or her questions and to explore the topic in greater depth. Most of them studied alone. Some of them got together to review the material and the explanation of the problem. Others talked to teachers occasionally. The group discussion, which was productive, left everyone with obvious feelings of satisfaction. After a 15-minute break, the group tackled a new problem using the same method.

What is going on in this medical school? What happened to the lectures, laboratories, and guided study? "Is this how students are learning to become physicians?" is a question often heard from visitors witnessing the Problem-based Learning (PBL) method for the first time. PBL is the major component in our program reform and the vehicle for the teaching reform underway at the University of Sherbrooke.

How does PBL compare to other methods for teaching medicine? What are the features of PBL? How is PBL applied specifically in Sherbrooke? Why was the method chosen? How are problems constructed?

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## The Use of Clinical Problems in Teaching

Let us begin by clearing up some confusion. Teachers have always liked to use clinical problems to encourage learning. Typically, the teacher would use a case to provide additional information during a lecture or, using the reverse approach, would present it as the initial stimulus. This is not PBL. In real problem-based learning, a clinical situation may be presented with the purpose of focusing students on the analysis and explanation of phenomena without ever discussing the diagnosis or management. On other occasions, the focus will be on problem solving. The teacher's intentions, problem structure, timing for presenting the problem, and problem use are aimed at producing different effects on students. Using clinical problems is a common feature of many methods, but the effects vary according to the strategies.

In his work on the taxonomy of different methods (Barrows, 1986), Barrows draws a distinction between a *clinical case* and a *clinical problem*. He defines a *case* as being a structured situation in which all the elements are provided so that students do not have to carry out investigation or synthesis. Barrows preserves the term *problem* for clinical simulations of complex structure in which the cues are not evident and in which the investigator progresses by setting forth plausible hypotheses and by seeking out the information required to understand and solve the problem. This classification makes it possible to describe the different methods and to propose three ways of adapting PBL to respond to the varied needs of students (See Table I).

Table I. Problem-based teaching methods

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### Case associated with a lecture

- concluding a presentation (lecture-based case)
- introducing a presentation (case-based lecture)

### Case method

### Problem-based learning (PBL)

- PBL centered on analysis (*problem-based learning*)
  - PSL: problem-solving learning
  - CRL: clinical reasoning learning exercises
- 

## Clinical Case Associated with a Lecture

### *Case concluding a presentation (lecture-based case)*

The teacher ends his presentation with a few examples of clinical cases to illustrate the

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material. The teacher may sometimes initiate a problem-solving process with a talk that is, in fact, a demonstration of the *application of principles* to relevant clinical situations. The teacher plays the active role.

#### *Case introducing a presentation (case-based lecture)*

Clinical situations are used to initiate an analysis process that evokes on student prior-learning in order to add information given during the lecture. Once again, the teacher plays the active role.

#### *Case method*

The case method, precursor of problem-based learning, was developed jointly in 1931 by the Harvard Business School and the Harvard Law School (Dewing, 1931; Christensen & Hansen, 1987). In order to prepare for class discussion, students received beforehand a complete description of a tangible case for study and research. Directly applying theory to the case facilitates comprehension and the relevance of the knowledge to be learned becomes immediately apparent. Although this allows students to play a more active role than in a traditional lecture, the teacher still directs and guides the discussion in the classroom. To avoid monopolizing the situation, a skilled teacher will question students and interact with them.

#### *Problem-based learning*

Problem-based learning in the strict sense (Barrows & Tamblyn, 1980; Barrows, 1985; Schmidt, 1983) focuses on having students analyze problems. They have to account for the situation by applying pathophysiological, psychosocial, epidemiological, or other fundamental concepts. Under this approach, the teacher becomes a tutor. He or she coaches students without passing on new knowledge. The tutor's role is to encourage the group to analyze the phenomena. As a result, students reactivate prior learning in order to formulate hypotheses. The knowledge acquired is restructured for application in understanding the problem. Students must identify their learning objectives, develop their own study plans, and apply new knowledge in order to understand the problem.

The PBL model centered on analysis is what we use in first and second year. For our students, it is a matter of learning basic and clinical sciences in order to be able to understand and explain clinical situations.

#### *Problem-solving learning (PSL)*

In the case of problem-based learning with problem solving, students add a sequence to PBL. After analyzing a clinical problem according to the PBL method, they consciously begin using the steps involved in problem-solving process by evaluating differential diagnoses and developing an investigative and management approach. We refer to this by World Health Organization terminology: problem-solving learning (PSL) (Guilbert, 1990).

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This method also uses problems as stimulus for inciting students to acquire knowledge and to develop clinical reasoning skills. There is, however, a difference in intention between PBL and PSL. Neame (Neame, 1989) precisely defines the models so that problems are designed according to the targeted goals and, as a result, their use sequence is planned. The problem-solving method requires that data be presented sequentially at the time that students will need them. Sessions normally begin with a synopsis that sets out the situation. Other data are revealed piecemeal depending on progress in the discussions. The method strives to mimic the information-gathering process used by clinicians in analyzing and solving problems. Barrows' team (Barrows & Tamblyn, 1980) at Southern Illinois University has outlined a series of modules that, when taken together, reform a simulated clinical case.

We use Problem-solving learning during the first semester of the third year, in which preclinical training ends with the multidisciplinary unit. The problems in this unit are structured differently, consisting of actual clinical cases that are often complex and which entail a number of components related to various systems and organs. The problems are presented sequentially; the outcomes and evolution are reported step-by-step. Despite the fact that the problems are presented sequentially, the format really does not imitate the clinician's hypothetico-deductive process adopted by students when they use Barrows' long menu booklet.

Third-year students initially tackle analysis of the problem on their own, not in a tutorial. They begin by sorting through the cues either throughout or hidden in the general presentation. They reactivate their knowledge to develop hypotheses that account for the problem. As analysis advances, new sequences either reinforce or eliminate their initial hypotheses. Students complete their analyses by organizing their hypotheses into a one-page summary and proposing an investigative and management plan.

Once the individual work has been completed, the group of eight students and tutor take up the analysis again to solve the problem. In pooling their efforts, students have to deal with different ways of approaching the problem, explore new avenues, and determine if they have applied new knowledge. The tutor's interventions focus on the process and not contents. The tutor invites students to ask questions, develop explanations, and to analyze in greater depth. As one might suspect, this is a very stimulating method. The starting point is a clinical context. In order to make progress, students must reorganize their knowledge and develop effective individual study habits. The obligation of being prepared for the group meeting strengthens motivation.

## Clinical Reasoning Learning (CRL) Exercises

We practice clinical reasoning learning using problem solving in small groups of five to eight students guided by a monitor. This method is both an adaptation of Barrows'

(Barrows & Feltovich, 1987) hypothetico-deductive process and an application of Kassirer's (Kassirer, 1983) iterative hypothesis testing with thinking-aloud procedure. One of the students in the group or the monitor works up an assessment of a real patient or studies the patient's file. Since he or she has all the information, he or she is referred to as the *database holder*. After a brief presentation of the clinical situation, the database holder cuts off before providing all the information about the patient's signs, symptoms, or test results. Immediately, the group members take up the analysis, imitating the process that a clinician goes through when first seeing a patient. The initial hypotheses require complementary information to be sought out. The database holder does not provide information unless the individual justifies the request. In other words, students have to think out loud and express the rationale for their requests. Hypotheses are put forward, discussed, and reformulated. The group works through the situation using the iterative approach that a clinician would use in investigating a patient's problem. Gradually, the group establishes a probable differential diagnosis, suggests an investigative and management plan, discusses them, and reconstructs group conclusions. During the discussion, each group member identifies gaps in their knowledge, making note of them as questions for individual study.

The monitor guides the clinical reasoning process by constantly requiring students to justify, interpret, explain, and explore more fully. The monitor plays the role of process expert, not content expert. The monitor is not there to share his or her own reasoning, but rather to share his or her clinical finesse by strategically guiding group reasoning. From the student's standpoint, this is a very stimulating learning method. In theory, it provides a response to a real situation and yields simulation that allows students to practice the clinical reasoning process (See Chapter 7).

In summary, using a clinical problem to stimulate learning is simply the common denominator of different methods from among which the teacher chooses depending on the effects that he or she wishes to produce in the students. The teacher must first consider the targeted objectives and then select the appropriate method. In Sherbrooke, problem-based learning is used in Phases I and II (the first two years of the program), while problem-solving learning begins at the start of the third year. The clerkship uses a special form of the problem-solving method inspired by Kassirer's iterative hypothesis testing approach and associated with the thinking-aloud procedure: clinical reasoning learning exercises.

## Description of the PBL method

The Faculty of Medicine of the University of Sherbrooke uses the PBL method for preclinical training. During the first two years, students are randomly assigned to groups of eight. The group composition changes with each new teaching unit, that is, every four to five weeks. Teachers serve as tutors for one or two units per year. Tutorials are given twice a week and last for about three hours. The students and tutor work around a table in

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a small room equipped with a large blackboard, a video monitor, an x-ray viewing box, and medical dictionaries.

### *The steps in PBL*

PBL is divided into ten steps that stretch over two tutorials (See Fig. 1). For the first 60 to 90 minutes of a tutorial, the group works on steps 7 to 9 of the previous problem. Then, after a break, they apply steps 1 through 5 in tackling a new problem. Step 6 is devoted to individual study.

The first seven steps, borrowed in full from Schmidt (Schmidt, 1983), are modeled after the steps of the scientific method, whereas the last three, an original addition from our Faculty, encourage students to determine the limits of their knowledge and to produce a summary of the activity. A closer look at each step will make it easier to understand this teaching method.

#### *Step 1. Read the problem and underline cues; clarify terms and data*

The students read the problem individually. They identify and cull out cues. They clarify specialized terms and words not understood at first glance. The objectives are to rapidly pick up on the meaningful cues pointing to the problem and to use medical terminology precisely.

The students read through the problem. Individually, they highlight the pertinent cues. The group agrees on the meaning of certain terms, using a dictionary as required. Although superficiality is avoided, this step is accomplished fairly quickly. It allows the group to distinguish between terms that can be defined immediately and those that will only become clear after analyzing or studying the topic.

The tutor does not necessarily try to get each term to be defined in detail, but rather to identify the ambiguities that can be dealt with during individual study.

#### *Step 2: Define the problem; draw up the list of phenomena that need to be explained.*

The group must provide a synoptic description of the problem that states, in a single sentence, the salient features summarizing the entire scenario. This is not a diagnosis; it is the reason for the consultation, along with its main circumstances. The objective is to get students used to producing an exact definition and description of a problem by culling out the essential information and setting aside the details.

After a short period of reflection, the students have to agree on a statement that summarizes the situation and its main features. If the case being dealt with is complex, the summary identifies secondary problems.

The tutor invites the group to describe, in a single sentence, what is occurring. Novices are not used to this type of exercise and find it difficult to separate the essential from the details.

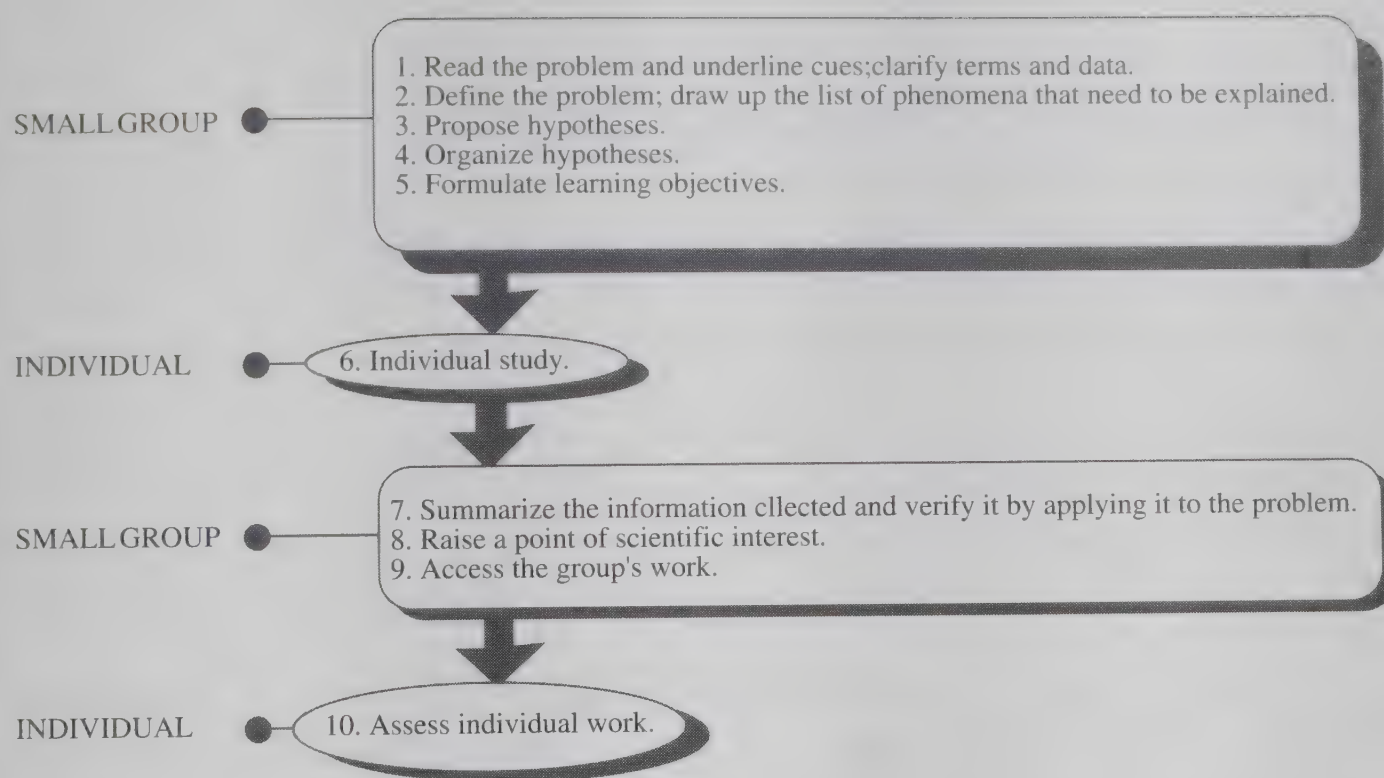


Figure 1. Steps in problem-based learning

### *Draw up the list of phenomena that need to be explained*

The group draws up a list of questions reflecting a consensus on the elements, phenomena, and interrelations that require interpretation or explanation. This is not an exhaustive list of cues, but rather an attempt to agree on the analysis plan to be implemented during the upcoming hour. The objectives are to identify, distinguish, and associate the meaningful cues; to iteratively formulate questions about what is happening, the sequence of events, and their relationships; and to gain experience in planning discussions.

The students review the cues that they have identified and draw up a list of situations, manifestations, and phenomena that require explanation. They list pertinent questions on the blackboard without trying to answer them. These questions serve as an outline for the steps to come.

The tutor reins members in to keep them from analyzing the problem before consensus on the list of discussion questions has been achieved. If necessary, the tutor can help the group round out the discussion plan. The following are examples of interventions: Which elements require an explanation? Can a list be drawn up as questions? What items should be listed for discussion, how should they be ranked, and how are they related? Have we forgotten to list an item brought up by a specific student?

The tutor reminds the group that the list of items for discussion must be drawn up without venturing into analysis.

### *Step 3: Propose hypotheses*

Analysis of the problem is based on the list of questions that require explanation. It is a question of determining the mechanisms underlying the symptoms and signs, accounting for them even down to the cellular or molecular level, and arranging them into a logical structure. It consists in applying basic sciences to clinical phenomena. The objectives are to optimize the learning conditions (the real benefit of the tutorial is to promote problem analysis rather than simply discovering the study objectives hidden in the cues); to reactivate information stored in long-term memory; to reorganize classification in long-term memory by establishing links between previously learned notions and the knowledge to be acquired during individual study; promote efficient encoding of knowledge by relating it to an actual clinical situation; and to establish pertinent and meaningful pegs for referencing new concepts during study periods.

Students use two sources in formulating hypotheses: knowledge stored in memory (that is reactivated) and rational, logical explanations that they develop but which are not necessarily true. This is the step that elicits the greatest participation from all. Each student puts forward an idea, then clarifies, develops, expands, or modifies it. This kind of brainstorming is not aimed at creating new hypotheses, but rather verifying and enriching them. After discussion, each hypothesis retained by the group is written on the blackboard. During discussion, the group identifies the need for more information and new knowledge. The learning objectives are recorded on the ancillary blackboard reserved for study questions.

Tutors often decide to maintain a low profile during this step. Sometimes they intervene with open questions to *guide the process* (How can the situation be accounted for? Are there other underlying mechanisms? Are there no more avenues that should be explored? Are there other foreseeable impacts on other levels?); *encourage deepening* (Why do you think that? Can you restate your intervention? What do you think of the opinion expressed by...? What elements would lead us to keep or reject this hypothesis?); *bring the discussion back on target* (Can we come back to a more methodical approach? Who can summarize what we have just found here? Before getting too specific, what can we say about more general processes?); or *manage time* (Can we come back to our discussion plan for Step 2? Since we are not making much headway, should this be a study question? What else could we research now?).

### *Step 4: Organize hypotheses*

This is the step in which the group produces a systematic inventory of the various explanations put forward and summarizes them. The mechanisms involved must be organized for grouping as generic or chronological causes to prioritize them, discover their linkages, and recognize associations. The summary takes the shape of a graphical representation, diagram, or schema on which question marks indicate points that remain problematic. The objectives are to cultivate greater intellectual skill, which consists in

organizing, recording priorities, establishing linkages and associations, learning to wind up work or a discussion with a summary, and looking for associations between current knowledge and knowledge to be gained from the next study period.

After time for reflection, the group prepares a summary of the discussions. The summary organizes, classifies, and groups the various explanations put forward in a chronological or generic sequence. It retains, removes, and ADH question marks; it establishes links in order to develop an overall representation of the problem, often in the form of a diagram. While the links may already have been created in Step 3, the group takes this time to agree on an overall representation that summarizes the problem(s). Since all discussions end with a summary, the group uses this step to more clearly delineate knowledge completely mastered from outstanding issues that will serve as study questions.

From the tutor's point of view, this is the most difficult step. The tutor must use various tactics to bolster the flagging strength of students: Could we take a few minutes to reflect before recapping? Who wants to begin the summary? What are most important points to remember from our discussion? Can anyone think of any connections between the hypotheses?

#### *Step 5: Formulate learning objectives*

This is the time for completing the list of study questions, that is, to define the specific information that each student must find in order to explain the phenomena presented in the problem. Priorities must be set and each learning issue defined concretely and realistically. The group develops a work plan, suggesting an approximate breakdown of available time and considering the best resources to be used. The objectives are to get students involved in identifying their learning needs and to get them used to building study plans based on specifically identified needs, specifying priorities, determining what information sources to use, and estimating how the available time should be used.

In practice, this step is actually carried out during the preceding steps. During discussions, the students have identified gaps in their knowledge, incomplete concepts, and uncertainties, which they have recorded as study questions on the smaller blackboard. After revising and completing the list, they come to a consensus on priorities. They especially try to delimit the topics. To group outlines a study plan that includes suggestions for the most appropriate resources and a preliminary breakdown of the available time.

Although students must discover the study objectives for themselves, the tutor can skillfully guide them throughout the session. If needed, the tutor can be more directive during the step to lead students to discover the objectives (which can be found in the *Tutor Handbook*). Generally speaking, the tutor's role consists in helping the students to more precisely specify and delimit the study objectives. The tutor may decide to go over the allocated time to allow less autonomous students benefit from the resources of peers who

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are more skilled at defining concrete, concise, and realistic objectives. The tutor's interventions may take the shape of questions: Instead of simply writing down which chapters should be studied, could we specify the most important aspects to study? What do you feel must be mastered? Have we forgotten that a given topic was controversial? What resources or references do you want to consult? How are you going to break down your study time?

#### *Step 6: Individual study*

Each student engages in independent study in order to find the information required to account for the problem and to cover the learning objectives. Textbooks are the basic tools at this stage. Students also use the resources of the Faculty's library, computer programs, videotapes, and lab work. Time has also been set aside to allow them to consult teachers who are experts in specific fields. Self-assessment exercises guide them in their study. Students have two or three days for independent study between group meetings. The objectives of independent study are to amass and master the information needed to account for the problem and to acquire the skills and attitudes necessary for self-directed learning.

To make the most out of each phase of independent study, students adhere to the following framework:

- Review the list of study questions prepared in the small group and adapt it to their individual needs by concisely stating each learning objective.
- Plan the independent study period so that there is a wholesome balance between intensive work and other personal activities.
- Identify the most appropriate information sources.
- Rapidly set aside material that is not relevant.
- Highlight essential information by underlining, restating, or summarizing it.
- Note ambiguous items for group discussion.
- Summarize newly acquired knowledge.
- Collect sound references to share with peers.
- Wind up the step with an assessment of the process used and its effectiveness.

#### *Step 7: Summarize the information collected and verify it by applying it to the problem*

The students meet again in their small groups and take back up analysis of the problem with a view to applying and verifying the notions acquired by coming to an agreement on the explanation of the problem. This step lasts from 60 to 90 minutes. The objective is to reorganize knowledge in order to validate comprehension, structure it in memory, reinforce its retention, and facilitate access to it; and to applying, restating, verifying, or critiquing the newly acquired knowledge.

Connections, associations, and encodings are added to memory to build a rich and easily accessible store of information. Peer assessments and critique provide an opportunity for self-evaluation and checking understanding.

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Students set the stage by presenting the resources used in turn and commenting on them, critiquing them, and sharing their discoveries. The exchanges are brief, limited to critiques of the preferences and not to contents.

The group then agrees on the most appropriate method for making the most of the allotted time. The discussion calls on acquired knowledge, not on reading texts and notes. The table is not covered with books and notes.

Usually, the group approaches the problem again by diagramming the explanations. The students share their discoveries, round out their knowledge, check their understanding, critique certain applications, and correct their own explanations of the fundamental process involved in the problem. They explore in greater depth the various opinions by explaining why they have accepted or rejected this or that hypothesis. The discussions conclude with a summary, which often takes the form of a new outline, and, if applicable, a plan for the probable solution. The exchanges can raise new questions for study.

In order to allow each student to benefit from the knowledge of other group members, a short period of time is reserved at the end of the step to clarify certain points arising from individual study that may have been misunderstood or controversial.

The tutor can proceed in a number of ways in depending on the nature of the problem, the complexity of the topic, the variety of the resources consultant, or a desire for change on the part of the students. Nevertheless, two elements must be retained. Firstly, before tackling the step, the group must explicitly agree on the most appropriate manner to proceed and on a discussion plan. Then the benefits from the step will come from discussion, not from recitation. The step must not turn into a short course; it must remain an occasion for applying theory to specific clinical situations. The opportunity must be used to reformulate, apply, critique, correct, and complete new knowledge. In this way, students use their peers to check their understanding, add connections, and make associations in order to eventually come to a consensus on an explanation of the problem.

In dealing with a particular problem, the tutor may decide to opt for a more appropriate approach by offering to discuss a complementary problem that involves the same concepts or by sharing cases taken from his or her own clinical experience.

#### *Step 8: Raise a point of scientific interest*

This consists in highlighting scientific discoveries or research issues that are still open. Students push their knowledge of a specific topic to the limit. The objectives are to share the joy of discovering the boundaries of knowledge and to stimulate scientific curiosity.

The students relax by taking turns in expressing their satisfaction at having understood a specific mechanism. They also formulate questions about a topic that they would like to research.

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To stimulate thinking, the tutor can ask certain questions such as: During this study period, was there one mechanism that you were especially pleased to discover? Was there an explanation or concept that aroused your interest so much that you would like to re-visit it? What concept would you like to develop further and eventually explore by carrying out a literature review? Could you state this concern as a specific research question?

*Step 9: Assess the group's work*

The group assesses what it has accomplished by looking at two aspects: the problem analysis process and the group's learning progress, on the one hand, and group dynamics, interactions, and working atmosphere, on the other (See Table II). In order for a group to function optimally, it must regularly invest time and energy in taking stock; in analyzing what is occurring within the group and how it is progressing; identifying strengths and weaknesses; and agreeing on targets for improvement.

Table II. Exploratory framework for group assessment

Contents
<ul style="list-style-type: none"><li>• Objectives achieved</li><li>• Clarity of learned concepts</li></ul>
Process
<ul style="list-style-type: none"><li>• PBL steps</li><li>• Roles of the students and tutor</li><li>• Time management</li><li>• Interactions</li></ul>
Atmosphere
<ul style="list-style-type: none"><li>• Interest and motivation</li><li>• Communication</li><li>• Collaboration</li></ul>

Pushed by time constraints and the task facing them, students may be tempted to skip this step. The scientific contents rally the group to the point that it masks operational problems. It is not easy to halt the process to check the atmosphere and to ensure that everyone is participating in a unified manner and respectful of differences in expression and personal difficulties. Nevertheless, the group is a powerful tool for maintaining individual motivation, acquiring communication skills, and displaying humanistic attitudes. It can help to identify at each meeting a specific group behavior to be worked on and to take stock of it during the next assessment.

Tutors generally act as facilitators during this step, since they are better placed to observe the process and group dynamics. Furthermore, their experience and maturity enable them to interpret modes of interaction, screen for problems, and to advise the group by applying the *descriptive feedback* techniques.

#### *Step 10: Assess individual work*

Students close out the study of a particular problem by drawing up their own personal assessments. They record what they have mastered and what remains to be done, making notes of the best references. The objective is to acquire intellectual discipline, that is, to always wind up in activity by drafting an assessment (what has been done and what remains to be done), which is a valuable habit for continuing education throughout one's professional career (lifelong learning).

Students are free to use whatever method they wish. For example, the student may decide to compile a set of note cards categorized according to systems or problems. Each day, he or she enters what has been done and what remains to be done. He or she may jot down the best references for revision or consultation. Whatever the method, the students will use this assessment to evaluate their progress and to forestall anxiety relating to not knowing how far along they are.

#### *The role of the students during a tutorial*

One of the features of PBL is to maximize the active participation of each student. The group depends on everyone's support. Each group member contributes individually, according to their styles and resources, to the meeting's effectiveness and atmosphere. Students also help facilitate tutorial proceedings by serving in four specific capacities: facilitator, secretary, scribe, and steward. Students take turns doing the first three jobs; the student serving as steward does so throughout the unit.

When a problem is first broached, the students take turns serving as *facilitator*. The facilitator manages progression from one step to the next. He or she promotes consensus-seeking in discussions, encourages participation, and facilitates interaction. If needed, the facilitator clarifies controversial issues or re-focuses the discussion when the group wanders off topic.

One student acts as *secretary* so that the remainder can follow problem analysis without having to take notes. The secretary follows the discussion and notes new elements on the blackboard. Using a blackboard allows everyone to pay attention to the process. In addition, extraneous material can be easily removed from the blackboard, leaving only the elements representing a consensus.

For greater clarity, the blackboard is divided into sections. First of all, the problem definition and the list of phenomena requiring explanation are written on the board. The

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largest section contains the many hypotheses formulated in step 3 (propose hypotheses). A portion of this will have to be erased to build a summary during step 4 (formulate learning objectives). As the process unfolds, the secretary writes down the learning issues on another blackboard. At the next meeting, the same person will serve as secretary for step 7 (summarize the information collected and verified by applying it to the problem).

The secretary's job is demanding. The person filling it must remain attentive, grasp the ideas put forward, ensure that they are clearly stated, and retain only the relevant elements. The secretary ensures that the information on the blackboard is clear by using abbreviations, arrows, and diagrams. He or she erases unnecessary information, collates data, and highlights important points. In addition, the secretary must reflect the group's opinions, not his or her own interpretation.

The *scribe's* task is straightforward: he or she transcribes the pertinent information from the blackboard onto paper (group consensus on steps 2, 4, 5, and 7) and makes photocopies for each member of the group for use during individual study.

Each group designates one student to serve as *steward* for the entire unit. The steward takes care of tutorial logistics, the distribution of teaching material, and communication between the group and program administrators. In addition, he or she compiles the problem assessments put forward by group members, references, and the means available to the group.

Lastly, a word about the *unit student representative*. At the beginning of each school year, students are asked to volunteer to serve as the representative for a unit. Representatives have the task of gathering the information from the stewards and drafting a unit assessment. Generally speaking, this includes a fairly detailed descriptive analysis focusing on the organization, atmosphere, orientation session, problem quality, the relevance of references, the usefulness of the formative examination, tutor interest, lecture style, and interest in laboratory work. The report's conclusion contains suggestions for improving the unit.

At the midpoint of the unit, stewards and the teachers responsible for the unit meet to discuss the atmosphere, how all activities are proceeding, and suggestions that can be rapidly implemented. At the end of the unit, stewards meet with the unit student representative to draft the assessment report.

### *Training in the PBL method*

Upon arrival, students are given two weeks of orientation in the new learning methods. This consists in workshops on program goals, the PBL method, and small-group dynamics. A number of rules on independent study and time management are also provided. Presentations and independent reading complement group discussions. Certain themes are revisited in workshops at six-month intervals.

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### *The tasks of an active tutor*

Under PBL, the teacher's role is radically different. As a tutor, his or her main concerns are to guide the analysis and clinical-reasoning process, maintain small-group dynamics, and stimulate motivation. Although the tutor has many tasks, experience allows us to classify them (See Chapter 9).

The tutor *manages the PBL method*. The tutor is in charge of the tutorial. He or she ensures that the analysis process proceeds sequentially and that the group works as a whole to this end within the allotted time. The tutor *helps the student facilitator* get all of the students involved in the process. The tutor only complements the student facilitator. The tutor's participation is more active in steps 2 (define the problem), 4 (organize hypotheses), and 7 (summarize the information). Preferably, the tutor should take over facilitating when the group assessment is being carried out in step 9. The tutor stimulates analysis. He or she pushes the group to consistently seek out that the underlying causes for events and to analyze them in depth, right down to the cellular or molecular level, but without tolerating superficiality. The tutor *motivates* students. He or she works to optimize the learning atmosphere and to elicit, in each student, the desire to learn the material. The tutor *evaluates*. He or she records the progress of each student, providing descriptive feedback and an evaluation while maintaining his or her capacity for intervention. The tutor *promotes autonomy*, using techniques to encourage the progressive acquisition of self-directed learning skills.

In short, the tutor is responsible for the quality of the PBL method used to promote student learning during tutorials.

That is how PBL tutorials run during the first two years in Sherbrooke's Faculty of Medicine. A different format is used for the PBL meetings in third year (See Chapter 2) and for CRL in the clerkship (See Chapter 7). Working in small groups with a tutor, our students follow a very structured procedure. But what are the intended impacts on their learning?

## Justification of the PBL Method

Educators have long asked themselves the same questions: Why do students forget so quickly? Why are they so often unable to use new knowledge appropriately? How can students do so well on exams, demonstrating that they have mastered the material, yet be unable to use the same knowledge to solve a clinical problem? It looked like they had understood everything. Why do lectures seem to sap student enthusiasm and interest? Despite the good intentions of preceding generations of medical educators, the system for training physicians has changed very little in the last 50 years.

After many failed efforts, Problem-based Learning offers an attractive conceptual framework. The motivation for choosing PBL is theoretically logical: it offers a set of educational strategies that are consistent with views in cognitive psychology. The question is whether PBL will produce more competent physicians. The premise is difficult to demonstrate, even if PBL puts the student at the center of the learning process (Nooman et al., 1990). The justification for PBL rests on its apparent validity. Nevertheless, there are a number of good reasons for adopting it.

The motivation for adopting PBL is based on three main educational objectives: optimizing learning conditions, stimulate motivation, and strengthening autonomy (See Table III).

*Optimizing learning conditions*

Schmidt (Schmidt, 1983) brought out the fundamental principles that form the framework for PBL. According to him, the three main conditions are activation of previous knowledge, encoding specificity, and development of acquired knowledge. Bordage (Bordage & Zacks, 1984), however, sheds light on the importance of basing the study of a domain on prototypes.

Table III. Justifications for PBL

GOALS	MEANS
Optimizing learning conditions	Activating previous knowledge Encoding specificity Development of new knowledge Study based on prototypes
Stimulating motivation	Student participation Reproducing the context for future practice
Strengthening autonomy	Training in problem analysis and solving Self-directed learning Communication and teamwork

*Activating prior knowledge*

The use of previously learned notions makes it easier to understand and process new information. Yet doing so requires that the memory be activated. To better understand new ideas, the student must follow a process that associates them with previously learned material stored in long-term memory. It should be fairly obviously that teaching methods differ in their capacity for activating appropriate previous knowledge (Mayer & Greeno,

1972). A student may be satisfied simply with storing knowledge in long-term memory. The initial steps in PBL, however, force students to make previously learned information available.

To illustrate, when students in a small group analyze a respiratory infection problem, they use prior knowledge in the areas of microbiology, immunology, preventive medicine, and so on. This initial analysis, which occurs before the topic is studied, forces students to reorganize the structure of the knowledge in their long-term memories in order to associate it with the new knowledge that they will acquire during individual study. In this manner, students develop a bank of easily useable, organized knowledge in their long-term memories.

All learning is therefore cumulative (Brandsford, 1979). Stimulating previous knowledge makes it easier to retain new knowledge. In order to maintain long-term memory dynamic and available, it is activated through planned "boosters" when subsequent problems are dealt with (Willems, 1981).

### *Encoding specificity*

Long-term memory has unlimited capacity; the problem is finding the information when needed. It is a question of accessibility. In order to activate the desired information, there has to be an existing connection between it and the organization of prior knowledge. Updating information depends on how it was stored. For example, a library book that has been put away on the wrong shelf is, for practical purposes, lost. Recalling information would be easier if it were associated with indexes, markers, or call modes encoded at the same time (Tulving & Thomson, 1973). When engaged in a learning process, we do more than simply accumulate knowledge: we associate it with cues that promote its subsequent reappearance. The role of the teacher therefore consists in anticipating situations in which the student will need to use the information, so as to also induce recall modes, to enable students to create their own associations in their memory.

The more that learning situations resemble future working situations, the higher the performance (Godden & Baddeley, 1975). Unfortunately, lectures present information mainly by subject, which does not tend to promote organization in memory that is conducive to recall during clinical rotations. The PBL method, on the other hand, presents problems so as to mimic, as closely as possible, situations that will occur during professional practice. The knowledge acquired in the context of a clinical problem will therefore remain more accessible in memory for analyzing and solving real clinical problems.

### *Developing acquired knowledge*

Information is better understood, processed, and reused when students have the opportunity to apply it in a practical manner. This can be achieved by questions, discussions,

summaries, or, ideally, through the reformulation and critiquing of hypotheses. It would appear that this results in redundancy in storage and leads to memory being restructured so as to prevent loss and promote availability (Gagné, 1985).

Under PBL, students come back to small-group analysis of a problem following a period of independent study. This immediate application of new notions enables them to verify their grasp of concepts and to strengthen information retention. Students create a bank of algorithmic associations in their memory that facilitates rapid access to the material.

### *Study based on prototypes*

People often wonder if the method ensures coverage of contents. How many problems must a student analyze before you can be sure that he or she has mastered the material necessary to practice medicine competently? Because time is a limiting factor. Bordage provides a partial answer to this question (Bordage & Zacks, 1984). He is trying to determine why, in certain clinical situations, students and physicians make mistakes that have consequences. In his opinion, the mode of organization of knowledge in the clinician's brain plays a critical role in the ability to solve problems.

Students learn material more readily and retain it better when exposed to a prototype rather than a series of examples. Consequently, according to Bordage, instead of attempting to memorize the 17 causes of dyspnea from their manuals, students would be better off mastering a prototype such as heart failure. It would appear that the prototype serves as an anchor for subsequent study (Gulmans, 1990). The importance of the prototype should guide the selection and construction of problems used in PBL. Students build on prototypes to accumulate new ideas, transpose them to other situations, and compare them to other categories.

### *Stimulating motivation*

Active learning implicitly stimulates motivation. In adult education, it is generally accepted that adults become increasingly responsible for their own learning process (Meyers, 1988; Wlodkowski, 1986) in addition, they prefer studying in response to specific needs and questions that they have come up with themselves. Adults enjoy participating in the process of seeking out answers. Should we not make use of this intrinsic strength when teaching students at the university level?

In PBL, the problem becomes the stimulus. It triggers learning and immediately proves to students that the concepts to be learned and applied are relevant. Analyzing the problem in small groups entices students to propose hypotheses and to try and prove them. The relevance of the material to be studied, its importance, and its meaning becomes much clearer in the light of clinical situations. Students therefore guide their study in order to explain information about the problem. In other words, they are working to answer personal questions. The fact that each student is partly responsible for the group's progress

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serves as a daily incentive to get to the root of difficult topics. Discussions with peers during tutorials allow each student to verify their understanding of the phenomena and to take advantage of a form of self-assessment. The PBL method sustains ongoing effort and does away with the last-minute postponing of work prior to examinations. Students find that sharing new knowledge with the group is stimulating; discussions feed the desire to explore topics more deeply. These motivational elements are evident to both students and teachers (Norman, 1979).

#### *Training in the problem solving and analysis process*

Mastering the analysis process requires discipline and practice. In a traditional curriculum, the teacher presents students with his or her approach to a phenomenon. Since the teacher explains everything, students need only to memorize. From the very outset in a PBL program, students must start training themselves to define the problem for themselves, to identify the phenomena that require explanation, to formulate hypotheses that reflect rational interpretation, and to determine study topics so that they can seek out information on their own in their books.

The work of physicians on a daily basis consists in analyzing and solving problems. In fact, medical practice is what allows physicians to develop appropriate, rapid, and effective clinical reasoning (Norman, 1979; Kassirer, 1989; Norman, 1989; Grant & Marsden, 1988; Elstein et al., 1978) Could we not prepare students for and speed up in some way the maturation process by exposing students to problems as soon as they enter the Faculty? Up to a certain point, PBL helps students to progress from the level of novice to that of expert in the art of making connections; associating knowledge; recognizing, using, and integrating concepts and principles for application in related fields. In such a system, the main role of the teacher-tutor is to encourage students in this process and to provide feedback on the collective and individual mastery of the analysis process.

#### *Self-directed learning*

Regardless of the method used, program objectives are essentially the same for everyone. With PBL, however, students have greater liberty for achieving them according to their own individual learning style. This student has responsibility for learning, while the teacher manages the problem-solving process instead of serving to provide information. The Faculty draws up the itinerary, but the student is behind the wheel. Each student must develop the discipline to manage his or her time. The weekly calendar therefore must be free of periods taken up by lectures in the past. This means that individual work is no longer relegated to the end of the day or less productive periods. Students manage their time according to their particular needs. They can devote more time to difficult topics rather than following the pace set by the teacher. Students therefore become familiar with how to find information, use books instead of class notes, and learn to naturally consult references.

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At the same time, PBL helps create self-assessment habits. In the second part of the tutorial, students can verify their understanding of the concepts studied and their ability to apply theoretical notions to practical situations and to transpose general principles to specific phenomena. Group discussion either confirms mastery or points out shortcomings.

In summary, PBL tends to foster the acquisition of self-directed learning and self-assessment skills and habits, which are essential to maintaining an interest in continuing education later in life (Walton & Matthews, 1989; Neame & Powis, 1981).

#### *Practicing the attitudes and skills required for group work*

Students feel that they share in the responsibility for contributing to group dynamics and progress. They learn to cooperate and to improve their interpersonal relations. They develop skills in listening, expressing their thoughts, interacting, and moving a discussion forward. They acquire and use basic concepts about small-group dynamics and optimal functioning. They put into practice theoretical notions about the art of giving and receiving feedback. In acquiring these attitudes and skills, students are guided by structured self-assessment activities, followed by the evaluation with feedback from the tutor and peers (St-Arnaud, 1989; Barrows, 1988).

### Building PBL Problems

*Dr. Bernard, a tutor, is perplexed. Last Monday, his group of eight second-year students was full of enthusiasm and creativity. The students had analyzed a respiratory problem, putting forward all kinds of ingenious hypotheses that would account for the physiopathology of the clinical situations and the disturbed arterial gases. After working for 90 minutes, they were anxious to go out and check the many questions raised during their discussions. Now, on Thursday morning, they came back, proud of what they had achieved in individual study. They enthusiastically re-tackled the analysis of the same problem. All the mystery and the ambiguities had disappeared. They had applied the physiopathological mechanisms that they had just studied in order to understand what was happening to the patient. Rachel was explaining a difficult point to John. Peter was correcting something that Lucy had misinterpreted. The session was moving forward rapidly, yet the tutor hadn't really had to intervene very much at all. The students wound up the problem with a summary that was even more complete than the one in the Tutor Handbook. After a break, they tackled the next problem: a patient with a mass in the neck. Now, however, the students were just going through the motions. They had lost their vivaciousness. Instead of bringing up hypotheses to explain phenomena, they were simply indicating topics that needed study. What had happened? The students and tutor claim that the problem wasn't suitable for PBL and that it needed to be revised.*

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### *PBL goals*

Walton and Matthews (Walton & Matthews, 1989) have a clear idea of what a tutorial problem is. They see it as a series of phenomena or circumstances presented in a specific arrangement that the student has not encountered before. This obliges the student to go beyond pattern recognition in understanding the problem. In fact, he will have to call on specific aspects of knowledge and comprehension, which must then be applied in a logical process in order to successfully identify the factors involved and their interactions.

The architect/engineer of a training system chooses the method based on the targeted goals. Therefore, the structure of PBL problems depend directly on the objectives targeted by the learning method (See Table IV). In fact, the medical schools that have adopted problem-based learning agree on these general objectives because of their main benefits to students.

Table IV. PBL Goals

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- Guide the acquisition and integrated organization of knowledge.
  - Promote the process for analyzing and solving clinical problems.
    - Stimulate motivation and the enjoyment of learning.
    - Develop self-directed learning skills.
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### *Models and strategies proposed in scientific literature*

The models of problems and strategies for using them detailed in the scientific literature vary according to student level and teacher intents, as Barrows demonstrated in his taxonomy of problems for a preclinical program (Barrows, 1986). Like in the McMaster group (Barrows & Tamblyn, 1980; Barrows, 1985; Neufeld et al., 1989). Barrows promotes a problem model based on actual clinical cases and which lend themselves to problem solving.

Moreover, Maastricht (Majoer et al., 1990) proposes a strategy in which notions are organized into a concept tree. Accordingly, starting with a major theme such as influenza, they would add on and then rank concepts belonging to several disciplines, such as the infectious process, prevention, and treatment.

The authors of the program reform at New Mexico (Kaufman, 1985; Kaufman et al. 1989) recommend that problems be more narrowly constructed and oriented towards the objectives of a particular fundamental discipline or linked to a specific clinical situation.

At Newcastle (Neame, 1989), Neame insists that models must be developed in response to the targeted goal or solving the problem. He proposes a sequential model in which the presentation of a succinct clinical model triggers the analysis process and elicits an information quest. The tutor does not provide additional information of the patient's condition or the evolution of the disease unless expressly requested to do so by a participant

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and at the appropriate time in the discussion. This approach is especially attractive since it is patterned on the process used by many clinicians.

### *The Sherbrooke model*

The first version of our problems tried to cover too much content. Teachers wanted to convey as much information in PBL as in a traditional curriculum. Problem scenarios were often loaded with cues that students were supposed to discover and transform into learning issues. This denoted a "pathological" concern with content to be covered.

Today, the situation is clear: the richness of a problem for discussion in tutorial comes from its ability to elicit in-depth analysis. The pedagogical issue at stake is the analysis process rather than simply discovering the learning objectives. If needed, the tutor can take a directive role in determining the objectives. Clinical situations are presented so as to encourage students to propose a series of plausible hypotheses that they attempt to validate through independent study.

Consequently, the scenarios for our second edition of problems are quite different. They offer a more general situation, since the cues relating solely to covering detailed content have been pruned away. A good problem leads students to carry out in-depth research on fundamental mechanisms rather than getting bogged down in details that account for specifics. First- and second-year students learn clinical sciences by using basic sciences to account for them. This is done by applying the PBL method. Using a problem as the starting point, students attempt to understand the phenomena and clinical manifestations by deepening their knowledge right down to the cellular or molecular level. They analyze the situations manifested by signs and symptoms, the evolution of the biological process, and its psychosocial impact without getting into a discussion of differential diagnosis or planning patient management. The focus is on problem analysis rather than on finding a solution to the problem. Often, the problem statement covers only one page.

## Construction of a Problem: A Seven-Step Process

Although we learned a great deal from discussions with other medical schools and experience, we continued proposing the same seven-step process until 1986 (See Table V). The first three steps can be considered as preliminary to problem construction, while the last three are complementary to it.

### *Step 1: Creating a multidisciplinary working group*

As we see it, PBL theory requires that the planning, construction, and implementation of a unit be given to a multidisciplinary working group comprising five or six teachers. Half of the teachers must be content specialists, clinicians, or fundamentalists, while the other half can be from other fields: internal medicine, family medicine, general surgery, pediatrics, radiology, and so on.

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Table V. A seven step process

BEFORE	1. Creating a multidisciplinary group
	2. Identifying priority clinical problems or situations
	3. Building the concept tree for a priority problem
THE TASK	4. Writing problem scenarios
AFTER	5. Drafting the <i>Tutor Handbook</i>
	6. Planning formative and summative evaluation
	7. Problem evaluation and improvement

The group is responsible for producing all the teaching material for the unit and works in a liaison with program administration. Their work is then reviewed by program managers, who check its relevance with respect to training goals, conformity with the PBL method, suitability for the level of the students, and its continuity with other units.

In order to convert a traditional curriculum, which is dominated by lectures, into a program centered on learning, each working group has to wipe the slate clean and rethink objectives, content, methods, and teaching material. Then they have to select themes that can be developed into problems, decide on key concepts, write the scenarios, evaluate the progress expected from students, and improve the material used.

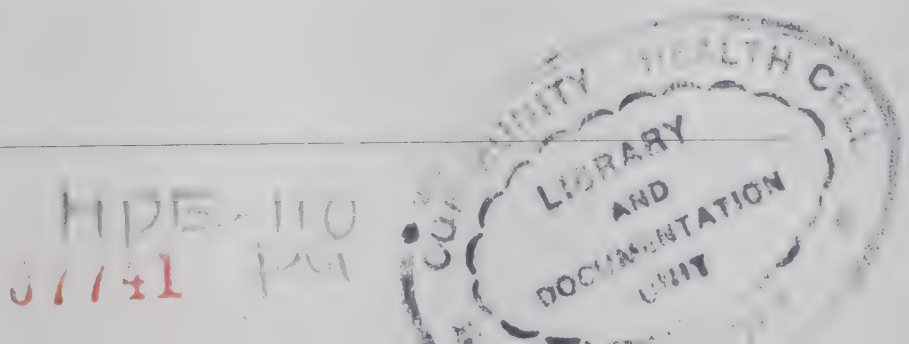
Step 2: Identifying priority clinical problems or situations

A unit lasts only four or five weeks; two problems are dealt with per week. Selecting themes to be developed is critical since only eight to ten problems per unit can be studied in depth. Because of time constraints, unit leaders did not always adhere to the proposed method. Those that persisted in attempting to convert all the topics covered by the traditional curriculum found it difficult to write realistic, stimulating problems. They wound up having to start over.

The method used at McMaster (Chong et al., 1984) provided the inspiration for the method we chose to identify clinical situations.

The method

It consists of an opinion survey on a list of potential priority clinical problems or conditions, such as palpitations, chest pain, and respiratory infections. The unit working group draws up the list.



*The sources*

The survey targets respondents from different settings: a generalist, an internist, a pediatrician, a surgeon, a family medicine resident, a clerk, and one or two specialists from the discipline.

*The selection criteria*

Respondents are asked to refer to selection criteria, such as in the widely used PUIGEP system (D'Ivernois, 1983), in providing their opinions on priority problems that medical students should examine.

**Prevalence:** The problems most frequently encountered in regular practice.

**Urgency or emergency:** Problems representing life-threatening situations on the short term or that may lead to serious consequences if not promptly detected and treated.

**Intervention:** Problems that can be modified through preventive, curative, or educative intervention.

**Gravity:** Problems with serious impact on the health of the patient, or on social or economic conditions.

**Educative example:** Problems that can be used to present important concepts; broach essential sectors in the health or basic sciences; or illustrate a number of concepts. Problems acknowledged as prototypes for organizing a knowledge base or initiating differential diagnosis.

**Prevention:** Problems in which prevention plays a predominating role and in which public education is emphasized as a priority responsibility.

*Weighting*

Respondents provide their feedback on each problem based on the selection criteria using a priority scale that goes from 1 (very low) to 5 (very high).

Since the list is always too long, the working group must limit its selections to priority themes.

*Step 3: Building the concept tree for a priority problem*

After agreeing on the list of priority themes, established through a survey or by other means, the working group defines the concept tree, based on the Maastricht (Majoer et al., 1990) method. A theme or health problem that is deemed a priority becomes the trunk of the tree with its branches representing epidemiology, the biological process, clinical manifestations, evolution, possible interventions, prevention, psychological or social consequences, and so on. The group draws up a list of concepts for each branch. The term concept means an essential notion, major principle, fundamental mechanism, or critical element that students must master to be able to account for a problem, clinical situation, or the evolution of a biological process.

Teachers have a hard time pruning the content and agreeing on the list of priority concepts. Occasionally, it takes hours of discussion, justification, and compromises to come up with a reasonable list. As a matter of fact, all teachers are profoundly convinced that students must learn and retain everything, at least in their area of specialization, even if the program only lasts four years. The group members individually weight each concept as being *essential* (+++), *important* (++) , or *useful* (+), which helps make reaching a consensus possible.

For example, the working group for the cardiovascular unit selected palpitations as a problem primarily because of its prevalence but also because it represents a model that students will be able to use later on in studying arrhythmias. The list of concepts comprises: pacemaker cell as opposed to undifferentiated cell, action potential, anatomy of conductive tissue, the reentry phenomenon, the classification of arrhythmias based on a narrow QRS (description of electrocardiogram tracings) as opposed to a broad QRS, identification of certain arrhythmias on a very characteristic tracing, mode of action of medications used to slow down ventricular response.

#### *Step 4: Writing problem scenarios*

This step consists in writing "real" problems by developing scenarios. This process starts with establishing the problem framework, which can be done as a group, although writing the scenario itself is a task better suited to one person.

#### *Problem framework*

The following questions must be answered in order to write the scenario.

- *When* in the unit sequence should the problem be presented? At the beginning or end of the unit, or during integration?
- What is the *level of the students*? Are there any prerequisites? Are we introducing new concepts or applying old knowledge to new context?
- How much *time will be allowed* for independent study? On average, Sherbrooke students have 15 to 20 hours of intensive work between two tutorials.
- What *concepts* should the students discover? Clearly identify them. Limit the number of major objectives (3 to 7 per problem) because students tend to go overboard. Providing enough time to deepen and digest the essentials is a must. If too much material has to be covered, students will try to memorize lists and diagrams rather than developing their own understanding of the problem.
- What would be the most appropriate and stimulating *format* for the problem? Video, paper, or standard patient? Would clinical simulation stimulate students more effectively on the emotional level?

#### *Writing the scenario*

Once the framework is ready, the scenario can be written. The greatest creativity can be achieved by having one person write the scenario. The guidelines that we have found to be the most productive in presenting a problem are provided below.

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**A real context.** Events or a series of phenomenon must be described in a neutral matter if they are to be accounted for by underlying processes, principles, or mechanisms. The patient is presented in a plausible context. Clinical documents must be drawn on in order to reproduce situations that are appropriate to the current functions and problems in medical practice. In short, reality must be simulated.

**An adequate level of complexity.** In order for a problem to be stimulating, its degree of complexity must be matched to the current knowledge of students. If not, students will not consider it as being a problem. Students are disappointed when the problems are presented as a list of cues corresponding to a series of learning objectives. Such a problem presents no challenge; it is merely a rehashing of the old program. On the other hand, if the problem is too complex, students will tend to give up when faced with what appears to be an insurmountable obstacle. Educational science has demonstrated these relationships: an adequate level of complexity stimulates; too high a level leads to discourage; and too low level leads to boredom. In this respect, the first problems for a unit are difficult to write. Students do not always have enough knowledge to explore several different avenues. Moreover, tutorials should not last more than three hours. In addition, each tutorial requires 15 to 20 hours of intensive individual work. Demanding more of students is unrealistic, especially since there are other activities going on at the same time.

**A sequential problem.** In the case of topics that are too broad, the problem can be divided into sequences, each representing one aspects. The tutor, who has a bank of information, makes opportune contributions of additional information that guide students in the creation of new hypotheses. Neame (Neame, 1989) recommends this method, which mimics the process often used by experienced clinicians. We have adopted it for constructing problems. A fairly short scenario describes the general situation, without too many specific details. After defining the problem, the students embark on a process to explain the situation by formulating hypotheses based on physiopathological or psychosocial mechanisms. The purpose of the discussion is not to establish a differential diagnosis, but rather to account for the situations by looking at the cellular, molecular, or even transmembrane exchange levels. The sequence ends with a summary that aims at organizing the hypotheses put forward. The discussion leads to a series of questions pertaining to patients and to the knowledge to be sought out. Then on to the second sequence, which is often shorter. The tutor contributes additional data from the *Tutor Handbook*. The tutor only provides new information at the opportune time and in response to specific requests from students. This information relating to the patient's condition, to its evolution, or to its investigation are limited but allows students to take up analysis of the problem once again, reorganizing the hypotheses and reducing them. These new cues also help them to focus their study needs more clearly.

**Problem cluster.** Sometimes at the start of the unit, a series of short problems are discussed during one tutorial in order to bring out a number of interrelated concepts or mechanisms

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(Majoer et al., 1990). When students begin a new field, they do not always have adequate prior knowledge on which to build hypotheses. The series of short problems has the advantage (and also disadvantage) of directing students towards specific objectives and prepares them, in terms of knowledge, for analyzing the more complex problems that will be presented in later sessions. They can also be offered to students to use when they wish as self-assessment exercises. Feedback must then be provided, either as suggested responses or specific references.

**Qualities of a didactic problem.** As a result of their experience in recent years, we have been able to identify three qualities that students and tutors use to gauge the value of a problem.

1. *The problem invites analysis.*

The problem must correspond exactly with the students' level of knowledge in order to activate prior knowledge and to formulate plausible hypotheses. The problem must state clinical situations that lead to general hypotheses that account for the situation. If rife with details, it results only in a list of study questions. If too centered on a diagnosis, it encourages students to play clinician by focusing on the differential diagnosis.

2. *The problem guides students in identifying the learning objectives.*

During small-group discussions, students identify their individual shortcomings and discover the concept tree. Problem analysis alone should naturally lead students to discover the priority objectives designed into unit.

3. *The problem elicits interest and stimulates motivation.*

The problem should replicate a real situation so that students can clearly see the relevance of what they are studying and how it will relate to their future needs. Study tasks should be easy to set; the work should be realistic with respect to the amount of time available. Students have an affinity for complementary but real material, such as X-rays, electrocardiogram tracings, and pathological exhibits. For this reason, it is often best to reserve them for the end of the tutorial to avoid overstating their importance.

*Step 5: Drafting the tutor handbook*

The *Tutor Handbook* is an indispensable tool to ensure consistency when a unit is presented by different tutors. It is designed for tutors who are not experts in the unit topic and to keep their preparation time to a minimum. It also allows tutors to intervene effectively. The *Guide* contains the following information.

- *A brief description of the problem:* This consists of a few lines of summary or a short explanation of the conditions or mechanisms at play.
- *The general goals and the list of concepts:* For example, "This problem is to introduce second-year students to the mechanisms underlying the major types of arrhythmias and their identification on electrocardiogram tracings." This is followed by the list of concepts or specific objectives.

- *The scenario with cues:* The tutor receives the same text as the students but with the cues underlined.
- *Complementary material:* This can be laboratory results, X-rays, electrocardiogram tracings, or the patient's chart. Information on how to present the material and when to use it is provided.
- *Intervention guide:* This maps out the projected learning path, the difficulties to deal with, priorities that should be stressed, and so on.
- *Annotated reference list:* A list of specific readings with notes to indicate the nature of the content treated and level is provided to minimize tutor preparation time.

In short, the *Tutor Handbook* provides everything needed to make the non-expert quickly feel confident and effective. It is a tool that the tutor cannot do without.

#### *Step 6: Planning formative and summative evaluation*

As soon as the problem has been written, planning for its evaluation must begin. Because of the self-directed learning context, students need a formative evaluation handbook to guide them in their work. In terms of question quality and format, this formative evaluation replicates the summative examination. Since PBL does not target sheer memorization of facts, but rather the application of basic principles and clinical reasoning, the multiple-choice questions must give way to other forms of evaluation. For example, short, open-response questions requiring the student to demonstrate his or her analysis or application skills could be used. Students also receive a question handbook with feedback in the form of answers or specific references that can be used once the study of a particular problem has been completed. The evaluation can also take the form of a short problem on a specific concept, accompanied by suggested answers or specific references.

#### *Step 7: Problem evaluation and improvement*

From the outset, we followed the Maastricht (Gijssels, 1990) practice of inviting students and tutors to critique each problem. We used a questionnaire with a five-point scale ranging from "excellent" to "very poor." In addition, we requested comments on every question.

#### *For the student*

At the end of each problem (after step 9), the group takes five minutes to fill out a questionnaire containing questions such as: Did the problem stimulate discussion with interesting and varied hypotheses? Did it lead to the identification of appropriate and realistic study objectives? What was the level of interest or motivation? Which references were the most useful? What improvements would you suggest?

#### *For the tutor*

At the end of each problem, tutors are asked to provide their own critique: Did the problem elicit spontaneous analysis? Did it guide students effectively towards the targeted objectives? What was the level of interest observed? How relevant was the acquired

knowledge? How would you rate the quality of the *Tutor Handbook*? What improvements would you suggest?

Up until now, students have faithfully filled out the questionnaires and compiled the results in a summary written up at the end of each unit. The tutors have been much less methodical.

## Templates for Constructing a Good Problem

From looking at our own experience and discussing with other faculties, we have come up with a few simple guidelines for constructing good problems.

1. The first goal of the tutorial discussion is to *analyze* a clinical situation in order to develop hypotheses that would account for it. A problem's strength lies with its ability to stimulate in-depth analysis. The discovery of study objectives is secondary to this.
  2. The type of problem *varies according to student level*. Accordingly, problems for first- and second-year students focus on analysis of data relating to a clinical situation rather than on problem solving per se. The task deals more with understanding mechanisms than with providing a differential diagnosis and the resulting treatment.
  3. Constructing a problem is a structured process in which, in the early stages, a *multidisciplinary group* comes to agreement on the targeted concepts or objectives and develops a problem framework.
  4. Writing the scenario is a task for an individual. Presenting a problem that is too broad or contains too many data leads to simply covering content. A more profitable approach is to start by *stating a general problem* that will allow students to explore several different avenues to account for the phenomena. At the opportune moment, the tutor can provide *complementary data* to redirect the analysis and to stimulate a new structure of hypotheses. This will provide more focused study questions.
  5. In order to maintain student interest, a *realistic simulation* of a problem that they will encounter in their future practice of medicine must be presented. In addition, the format must be varied, ranging from paper-and-pencil to video presentations and, upon occasion, simulated patients.
  6. A highly detailed *Tutor Handbook* is an indispensable tool for nonexpert tutors. But many more observations will need to be consolidated and additional research carried out in order for the critical elements of a problem presented in a tutorial to produce an optimal teaching outcome.
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Summary: Constructing PBL Didactic Problems		
GENERAL OBJECTIVES	<ul style="list-style-type: none"> <li>• Guide the acquisition and integrated organization of knowledge</li> <li>• Promote the process for analyzing and solving clinical problems</li> <li>• Stimulate motivation and the enjoyment of learning</li> <li>• Develop self-directed learning skills</li> </ul>	
SEVEN-STEP PROCESS	<p><b>BEFORE</b></p> <p><b>THE TASK</b></p> <p><b>AFTER</b></p>	<ol style="list-style-type: none"> <li>1. Creating a multidisciplinary group</li> <li>2. Identifying priority clinical problems or situations</li> <li>3. Building the concept tree for a priority problem</li> <li>4. <b>Writing problem scenario</b></li> <li>5. Drafting the <i>Tutor Handbook</i></li> <li>6. Planning formative and summative evaluation</li> <li>7. Problem evaluation and improvement</li> </ol>
WRITING THE SCENARIO	<ul style="list-style-type: none"> <li>• Timing of introduction in the unit is based on student level</li> <li>• Number of concepts to be discovered (3 to 7)</li> <li>• Realistic context and varied format</li> <li>• Appropriate level of complexity</li> </ul>	
QUALITIES OF A DIDACTIC PROBLEM	<ul style="list-style-type: none"> <li>• Problem invites analysis</li> <li>• Guides students in identifying the learning objectives</li> <li>• Elicits interest and stimulates motivation</li> </ul>	

## Conclusion

The ultimate objective of medical education is to prepare students for the practice of medicine so that they will be able to evaluate and manage medical problems in an effective, competent, and humanistic manner.

The traditional model for medical education is based on the premise that students must first acquire a fund of factual knowledge before attempting to analyze or solve a medical problem. The lecture is the main instructional mode under this model. Teachers present what they know to the students and periodically verify how much they have remembered.

Problem-based learning turns the process around, starting with the problem first. Under PBL, the problem serves as the stimulus for discovering concepts, principles, and data necessary to explain the phenomena or events. Any initial analysis carried out in small groups reveals what information is missing and yields a list of study questions. Individual study serves to fill in the missing information. The new knowledge is stored in long-term memory, encoded so as to facilitate recall when examining a similar clinical problem. After individual study, the members of the group meet again to re-examine the problem as well as to validate the newly learned material and deepen their comprehension of it.

Of course, PBL is not a panacea; nor is it the only way to center a program on students. It does, however, definitely promote motivation, the efficient organization of knowledge in memory, the practice of analysis, the development of self-directed learning skills, communication, and interpersonal relations (Albanese & Mitchell, 1993). For the Faculty of Medicine at the University of Sherbrooke, PBL has proved to be an excellent mean for transitioning from traditional teaching to an approach that is more centered on the learning process.

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## Teaching-Learning Clinical Skills

Guy Lacombe and Jacques E. Des Marchais

*Tell me and I will forget  
Teach me and I will remember  
Involve me and I will learn  
- Chinese proverb*

### Introduction

As a result of the Flexner (1990) reform at the start of the 20<sup>th</sup> century, medical training in North America shifted from the doctor's office to the university. Since then, the gap between the patient and the future physician has unrelentingly widened. The phenomenal growth in biomedical knowledge from 1930 to 1960 gave added impetus to "scientific instruction". Gone is the "master" who passed on his or her science and art of dealing with patients on a day-by-day basis. The knowledge of the "new master" is limited to his or her specialty. The training of scientific students had to be standardized. In complying with the "scientific" model, medical schools developed a new prototype of student: learned, but lacking know-how and interpersonal skills.

What is more, science and technology are progressing so rapidly that students have no hope of "learning everything". Of course, they have to learn as much as possible. On the other hand, they must unquestionably master know-how and interpersonal skills in order to work with the patient and with other health-care providers for the well-being of the sick and the community.

Viewed from this perspective, and in order to center training on the student, practice, and the patient, the new program required that clinical training be completely revamped, starting with the preclinical phase. This resulted in the *longitudinal* clinical skills learning unit. This unit, which stretches over two years of preclinical training, brings together various activities relating to clinical exploration, mastering clinical maneuvers, and personal growth.

The chapter begins by clearly stating the problems associated with teaching clinical skills. The second section describes how the unit is conducted and provides information on its activities. The third section analyzes unit content and its features with respect to the major objectives of reform. The fourth deals with problems encountered during implementation and summarizes the challenges ahead. The chapter concludes with a plan for improving the unit.

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## Problems Associated with Teaching Clinical Skills

The Hippocratic oath enjoins each physician to pass on his or her art to younger colleagues. This kind of teaching is self-evident. Let us take a look at it from the perspective of the traditional context and with respect to our local needs for change, community needs, the needs of medical science in terms of the practice of medicine, and lastly with respect to the cognitive organization of clinical knowledge.

### *Traditional teaching: Restrictive and decontextualized*

Traditionally, programs for teaching clinical skills teach how to take medical histories and perform physical examinations. Starkly technical in nature, these lessons look like poor cousins when compared to more spectacular modern methods and technologies: examining for low back pain pales in comparison to the startling images provided by nuclear magnetic resonance imaging. The medical history and the physical examination, which are basic to any diagnostic process, require that the physician remains with the patient and give the patient all his or her attention. This contrast with "tests", whose margins of error are often forgotten, and which often dictate care objectives that are far from what the patient wants or really needs. Clinical skills lose their true clinical meaning when they are taught outside of a diagnostic process aimed at the identification of health problems. Students fail to see the relevance of clinical skills to problem solving when they are not taught concurrently with the medical sciences.

The clinical application of competencies requires that maneuvers and behaviors be integrated, and that communication is carried out effectively, especially in complex situations. But how does one go about determining the specific objectives for a guide on teaching communication skills and attitudes (Guilbert, 1990)? Some vague areas resist definition.

Which teachers feel that they have a stake in teaching clinical skills? Today, the cardiologist takes charge of teaching the cardiac examination; the neurologist, the neurological examination; and so on. But who examines the patient as a whole? Who provides students with feedback on their progress in mastering clinical skills? Who appreciates the integration of the skills into a diagnostic process?

### *Local need for change*

Clinical teaching in Sherbrooke had been revised just a few years before the new MD program was implemented in 1987. As a result of the revision, clinical teaching started in the first year of the program. It appeared articulated and progressive; one might have been led to think that there was no need to change its structure or activities. Nevertheless, students and graduates were surveyed, revealing a whole series of problems (Lacombe, 1987). Twenty general practitioners in non-university settings, ten specialists, and ten residents were invited to identify skills that they thought should be developed in order to enhance their practice; training shortcomings related to aspects of the physical examination and medical history; and their most painful clerkship memories.

Above all, the responses underscored a weakness in the musculoskeletal examination, a neurological examination, and the pediatric examination; the *absence of an organized structure* for taking a medical history; difficulty in effectively conveying relevant information to the patient; and difficulty in questioning certain specific categories of patients (problems relating to drugs, alcohol, sexually transmitted diseases, depression, and so on). Some responses revealed difficulties encountered when entering the clerkship: apprehensions related to superiors having different requirements for history-taking; doubts when facing "tricks" in the examination; humiliation in admitting that one was unable to perform simple technical maneuvers such as inserting a catheter; isolation and suffering when faced with patients at death's door.

The way that clinical skills were taught under the old curriculum therefore did not meet all learning needs.

A second study carried out in 1988 among students (from the first year of medical school to the first year of residency) focused on their perception of care provided to the elderly (Lacombe, 1992a; Lacombe & Larente, 1991). The survey dealt with the personal experience of respondents with respect to disease, death, and suffering; certain aspects of communication; their concern for the patient; and their perception of the elderly, handicapped patients, and patients with psychiatric disorders. Five hundred students responded to the questionnaire. Many of them had already had experience with illness and care. These experiences, which had been painful (See Table I), diminished their willingness to intervene in what are fairly frequent clinical situations (mental health, the elderly, neoplasia). This suggests that the factual information acquired does not succeed in modifying the perception that students have of the elderly. And this perception would tend to skew their knowledge.

Table I. Study on the perception of disease and care

- Student experiences with disease and care:
- 50% of students had been hospitalized or received care in an emergency room over a period of more than 12 hours.
  - 32% had to manage, for more than 24 hours, one or more patients outside of a work or training setting.
  - 50% had experienced the loss of a loved one. Most of them still felt the burden of personal suffering.
  - 40% of first-year students deemed communication of the training priority for practicing quality medicine; the percentage decreased as the number of years of training increased.

The old curriculum took less account of resistance to the acquisition of know-how and attitudes than to the acquisition of factual knowledge. Neither did it provide positive contact with these areas of intervention.

### *Community needs*

The public generally complains less about the professional acts of physicians than about the processes that accompany them. Despite the fact that medicine is perceived as very learned, physicians are no longer seen as "good doctors" (Gibbs, 1989). Clinical skills, know-how, and medical attitudes therefore require a broader training, especially since the consumers of care are increasingly demanding.

Being a physician no longer means simply understanding biology and applying it to a problem. Patients have to be approached in a manner that they find understanding, acceptable, and desirable. The physician must be a consistently effective communicator able to respond to patient needs and expectations. Over 50% of instances of legal action taken against physicians in Canada are directly related to problems in communication, misunderstandings of the expectations of the parties, and their possible actions (Messenger, 1991).

### *The needs of medical science and the practice of medicine*

A physician cannot really get to know a patient or understand the patient's needs through a one-time evaluation of an illness. Disease intrudes on daily life; it pushes aside activities, shakes one's self-image, and puts off things that one wants to accomplish. Disease reveals unsuspected qualities, adaptability, and strengths as well as weaknesses that are difficult to accept. Medical teaching interventions that are limited in time and carried out in a hospital setting do not appear to promote a dynamic perception of health and of the person struggling with the disease.

From the patient's perspective, personal contact reflects humanistic medicine. Medicine has always been inherently humanistic. Yet with the emergence of technical medicine, physicians must explicitly express their humanism through concern about the specific and varied needs of their patients. Even experienced physicians find it difficult to balance the needs and requirements of the individual (to be seen immediately, to get the latest medication everyone is talking about) with professional imperatives (apply the best technique and monitor costs).

The teaching of humanistic attitudes is too often confused with training in the humanities. But let us be truthful: the physician remains above all a scholar of medical science. There is no question of forcing physicians to invest years in the study of philosophy or psychology or to undergo extensive training in sociology, communication, religion, history, foreign languages, literature, economy, ethnology, or any other branch of the humanities that allows us to deepen our understanding of humankind (Pellegrino, 1979).

We realize that it is impossible to impart to physicians all the knowledge of their profession, yet paradoxically, we would like them to demonstrate perfect mastery of know-how and attitudes in their patient relations. The physician must be able to make a diagnosis based on science and administer treatment. Any less than this is less than a physician, and even less a "good doctor". A "good doctor" goes beyond this minimal definition (See Chapter 6), yet competence is a prerequisite for humanism. By the same token, one could not pretend to be competent in interdisciplinarity or community health based on a few activities taken during a four-year program. The risk remains that this kind of limited training could lead to "pseudo-competence". You can not train a psychologist in 45 hours, even if you can give a student a broad enough vocabulary to demonstrate that he or she has a fairly good grasp of the basic concepts. But that is a long way from maintaining that he or she would be prepared to intervene appropriately with patients dealing with real problems.

Students attracted by medical intervention care about human contact and the helping relationship. Not being able to express this concern, however, can lead to significant anxiety, decreased motivation, and feelings of having made the wrong career choice. These are all conditions found in students in conventional curricula (Huemner & Royer, 1981). Because of rapid advancement of science, the initial training is no longer adequate to ensure professional competency. Our physicians must be able to learn independently, to identify their training needs, and to act accordingly.

#### *Needs related to the cognitive organization of clinical knowledge*

Students are often criticized for using scientific language when talking to patients. Students tend to solve problems as they would examination questions. Patients, on the other hand, do not have relatively well-defined symptoms...they have real diseases. In fact, clerks are simply using the information as it was stored in their cognitive systems. Bordage (Bordage, 1982) stresses the importance of this organization of knowledge in problem solving. In Kassirer's view (Kassirer, 1989), the clinical process comprises rules that govern choices. Interventions are more effective or easily carried out the more the problem resembles a situation studied during training (Thomson & Tulwing, 1970). By getting closer to the patient, using language that he or she understands from the clinical perspective, students can use clinical skills to use fully reorganize the knowledge that they have memorized. Problem-based learning of the various systems should theoretically facilitate the manipulation, reorganization, retention, and recall of knowledge.

### The Sequence of Steps and the Structure of Sessions

The longitudinal clinical skills unit starts in mid-January of the first year. It continues throughout Phase II. In other words, it covers the second semester in the first year (stage I), both semesters in the second year (stages II and III), and the first semester in third year

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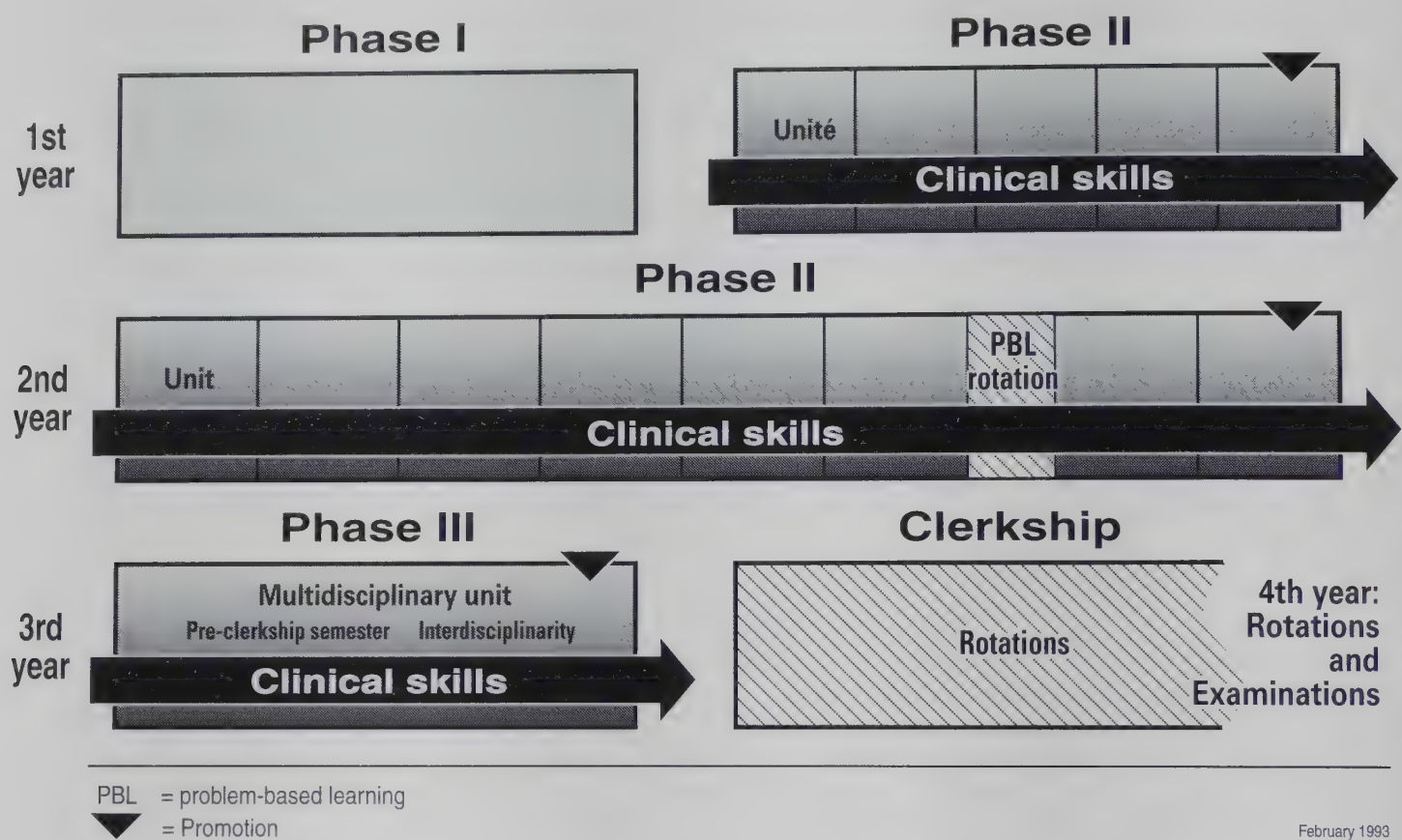


Figure 1. The MD program

(stage IV), ending at the same time as the multidisciplinary unit (Unit 14) and the pre-clerkship activities. It stretches over two years and takes in 70 sessions (one three-hour session per week). Each university semester represents one of the four steps (See Fig. 1) designed to achieve the general objectives (See Table II).

All the activities are carried out in groups of eight students randomly selected at the beginning of each term; two clinical monitors working in tandem are assigned to the groups. More than 70 teachers from all departments take part of voluntary basis in teaching clinical skills; they are remunerated according to the university activities reward system (See Chapter 10).

Sessions during Stages I and II are theme based. They always follow the same learning situation model. Each session includes clearly identified specific objectives that fall within two main areas: *communication and humanism* and *collection and presentation of clinical information*. The teaching is simultaneous and continuous; all students take part in the same activities at the same time.

In Stages III and IV, each session is devoted to an activity that falls within the same areas. Students take part in activities that are *specialized* or relate to the *diagnostic process*. *Specialized* activities focus on a specific intervention context, such as palliative care, or a

Table II. General objectives for the lonitudinal clinical skills unit

In order to become a good clinician, the future physician must develop, during preclinical training, the skills that will allow him or her to play an active role in the health-care team, in addition to acquiring scientific knowledge. These skills specifically include:

- Establish and maintain a physician-patient relationship based on humanism, empathy, and integrity.
- Promote health by taking into account the social, psychological, and physical environment of the patient and by making a distinction between the patient and the disease, the handicapped person and the handicap.
- Exchange (in a cooperative relationship) the information required to promote health, establish a treatment contract, or enable informed consent.
- Effectively gather subjective and objective information.
- Organize the objective and subjective information gathered, when performing a history and physical examination, according to a structure that facilitates the diagnostic process.
- Practice simple diagnostic and treatment techniques while remaining attentive to the individual who must undergo them.
- Interpret information as well as laboratory tests taking into account their limitations and their respective worth within a diagnostic and decision-making process that reflects the scientific method.
- Communicate with professional interveners both verbally and in writing.
- Recognize the potential for and the need to delegate actions or to seek out more qualified personnel.
- Carry out self-assessment and self-critique in order to maintain, improve, or acquire the knowledge and skills necessary to maintaining one's competence.

specific intervention technique, such as inserting a urinary catheter. The *diagnostic process* brings together elements from the medical history and the physical examination in order to identify and solve clinical problems.

Taken as a whole, the clinical skills learning sessions bridging the four stages represent about 20% of the time in a student's schedule. Summative evaluation is carried out at the end of each stage to determine if the objectives have been achieved and if the knowledge acquired in preceding stages has been retained. This consists in a written exam with open short-answer questions (OSAQ) and problem-analysis questions (PAQ) as well as objective structured clinical examination (OSCE). Evaluation relating to the diagnostic process in Stages III and IV also includes evaluation carried out by the monitor on taking a medical history, performing a physical examination, and formulating diagnostic impressions.

Each stage includes a series of subject topics or learning activities that correspond to specific objectives within the framework of a continuous, longitudinal, and spiral process for mastering clinical skills in the two areas of *communication and humanism* and *collection and presentation of clinical information* (See Table III).

A range of intermediate objectives enables students to enhance their clinical skills progressively and sequentially in each of the stages (See Table IV).

Table III. Study topics in communication and humanism and collection and representation of clinical information during the four stages

Communication and Humanism	Collection and Presentation of Information
STAGE I	
Introduction to the interview	Specific topics integrated into PBL units
The patient	System-based exploration of symptoms
The disease and autonomy	Physical examination
The medical student	
STAGE II	
The difficult interview	
Physical contact with the patient	Specific topics depending on the PBL unit
Informing the patient	Medical history, risk factors
Oral presentation	Physical examination
STAGE III	
Integration of the two areas:	
<ul style="list-style-type: none"><li>• Diagnostic process and problem-based structured</li><li>• Palliative care and death</li><li>• Interdisciplinarity</li><li>• Exploration of sexuality and the genital examination</li><li>• Dermatology and nudity</li></ul>	
STAGE IV	
Integration of the two areas:	
<ul style="list-style-type: none"><li>• Diagnostic process, diagnostic development, and differential diagnosis</li><li>• Geriatrics, chronic care, and interdisciplinarity</li><li>• Pediatrics and third-party intervention</li></ul>	

### *Introductory session*

The first three-hour session includes presentation of the *General Guide*, which explains the objectives, teaching method, and evaluation method that are designed to gradually integrate students into the health-care team throughout the clinical skills learning unit. It also serves to position first-year students with respect to patients. Short presentations recall experiences with disease and health care that all students have had, which underscore the relevance of what will be taught during the stage.

During Stages I and II, sessions on *communication and humanism* alternate with those on *collection and presentation of clinical information*. All the sessions on information collection relate directly to the concurrent PBL unit. The sessions on *communication and humanism* are independent of the content of PBL units.

Table V. presents the themes for the sessions during the four stages. The distinction between the contents of *communication and humanism* and that of *collection of information* can be clearly seen in Stages I and II.

### *A typical session in communication and humanism (Phase I and II)*

The *General Guide* outlines a typical session on *communication and humanism*. Each session includes a text called "Learning Method" that specifies the tasks to be carried out. Let us take a look at a typical session with a simulated patient, including role playing, which contains seven steps.

1. Meeting with the monitor: the monitor recalls the objective for the session and assigns patients (length: 10 minutes).
2. Meeting with the patient: one or two students per patient (45 minutes).
3. Diary: personal reflections on the meeting (15 minutes).
4. Group plenary with the monitor: open discussion on the meetings with patients (about 30 minutes).
5. Role-playing on the session theme (10 to 15 minutes): assignment of roles, feedback on the role-playing (10 minutes), assessment of the interview (10 minutes).
6. Exploration of the theme or objective (about 45 minutes).
7. Evaluation (diary signed by the monitor).

### *Preparation*

Prior to each session, students must read a page in the *Guide* corresponding to the activity. Then, they are asked to recall their experiences and memories relating to the session's specific objectives. To illustrate, in the session entitled *My First Patient* (students have already encountered a number of patients in a health-care setting during the immersion

### *Meeting with the patient*

Normally, one patient is assigned to every two students. One of the students initiates the

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rotation at this point), students are invited to ask themselves: Was my first patient really mine? Was it responsibility, a role to play, or simply a specific request from the setting? How did I feel in this role?

Table IV. Intermediate objectives for each of the four stages

<p><b>Stage I</b></p> <p>Demonstrate attentiveness and empathy with a real or simulated patient by following the interview steps and procedures studied.</p> <p>Evaluate, based on a grid, the technical steps in interviewing when observing a relationship with a real or simulated patient.</p> <p>Recognize the effective or social consequences that the disease may have on the patient or on his or her community, based on the medical histories of real or simulated patients.</p> <p>Collect subjective information about a problem during a real or simulated interview based on the <b>seven sub-elements for each problem</b>.</p> <p>Collect objective information from the physical examination of the systems under study in compliance with the <b>described</b> method (Thomson &amp; Tulwing, 1970).</p>	<p><b>Stage II</b></p> <p>Demonstrate the retention of skills acquired in Phase I.</p> <p>Recognize and apply specific interviewing techniques that apply to different patient situations during real or simulated interviews.</p> <p>Recognize and apply the basic rules relating to physical contact with a patient, perspective privacy, patient information, and oral presentation during rounds.</p> <p>Collect subjective information relevant to the medical history, evolution, risk factors, and a review of systems related to the unit studied.</p> <p>Collect objective information from the physical examination in compliance with the proposed method.</p>
<p><b>Stage III</b></p> <p>Demonstrate the retention of skills acquired in Stages I and II.</p> <p>Recognize crisis situations experienced by a real or simulated patient, primarily in a chronically ill patient facing death or struggling with sexual problems; propose appropriate modes of intervention.</p> <p>Conduct self-evaluation and self-critique; restructured the interview with the patient or with other professionals; defying the related treatment contract.</p> <p>Practice performing a complete physical examination of a normal adult, including dermatological, urological, and gynaecological assessment.</p> <p>Write up a medical history and a physical examination, a list of problems, and a note on the evolution based on a real or simulated situation.</p> <p>Structure diagnostic impressions based on the diagnostic process.</p> <p>Applying safety precautions relating to blood and sterile technique when performing venipuncture and urinary catheterization.</p> <p>Recognize normal and abnormal characteristics of blood smears.</p>	<p><b>Stage IV</b></p> <p>Demonstrate the retention of skills acquired in Stages I, II, and III.</p> <p>Recognize crisis situations experienced by a real or simulated patient and applied the basic rules of crisis intervention.</p> <p>Established a treatment contract.</p> <p>Recognize certain abnormal and normal features of the fundus of the eye; practice cardiac and pulmonary auscultation as well as the dermatological examination.</p> <p>Practice performing a complete physical examination of an adult, child, and elderly person, taking into account the evaluation of pathologies, their growth, and their degree of independence.</p> <p>Draft a list of problems.</p>

Table V. Specific themes for the 70 clinical skills sessions

<b>Stage I</b> 1. Introduction to clinical skills 2. Introduction to the interview 3. Denver and independence, prespectivefile 4. My first patient 5. Neurology I 6. Facilitation 7. Neurology II 8. Neurology III 9. The role of the patient 10. Vital signs 11. Risk factors 12. Verbal language 13. Formative evaluation and self-critiquing 14. Musculoskeletal system I 15. Nonverbal language 16. Musculoskeletal system II 17. Reaction to the disease 18. Psychiatry I 19. From the person to the handicap 20. Psychiatry II 21. The formative interview 22. OSCEs and OSAQs; summative evaluation	<b>Stage II</b> 23. Patient contact 24. The breasts 25. Cardiovascular system I 26. The difficult interview: contents and discourse 27. Cardiovascular system II 28. The difficult interview: personality and emotions 29. ORL/ophthalmology 30. Informing the patient 31. Respiratory system 32. Presentation according to SOAP* 33. Formative evaluation and self-critiquing 34. Abdominal examination 35. Integration of the medical history 36. Integration of the medical history and physical examination 37. OSCEs and OSAQs; summative evaluation
<b>Stage III</b> 38. Death and palliative care I 39. Death and palliative care II 40. Dermatology 41. Visual recognition, hematology laboratory 42. Urinary catheter and sterile technique 43. Male genital examination 44. Sexual assessment 45. Venipuncture and blood precautions 46. Femal genital examination 47. Formative evaluation and self-critiquing 48. Demonstartion of the integrated medical histroy and physical examination 49-56 Videotaped interview and examination Theoretical exploration of a symptom Fever abdominal pain, edema 57. OSCEs and OSAQs; summative evaluation	<b>Stage IV</b> 58. Pediatric evaluation: the neonate 59. Pediatric evaluation: the child, prospective file 60. Geriatric evaluation: chronic care; prospective file 61. Geriatric evaluation: interdisciplinarity 62-69 Complete examination, diagnostic process Direct observation or video 70. OSCEs and OSAQs; summative evaluation

\* SOAP stands for Subjective Objective Assessment Plan, used in American medical literature to designate a problem-based approach to clinical skills.

Required reading

Students then confront their experiences and opinions with the required reading. In the case of *My First Patient*, a physician relates his or her first encounter with a patient, his or her apprehensions about the patients' and their families' expectations, and the anxiety caused by these experiences, his or her feelings of ignorance about how to act, attitudes to be taken, and so on.

Meeting with the monitor

At the beginning of the session, the group of eight students guided by the monitor must define the specific objectives for the patient interview. Each student must also identify a personal objective that she or he had already considered.

interview, while the other observes. The student gets to know the patient from the professional standpoint; the student gets the patient to specify the reason for the consultation and explores the patient's main symptom. As the student's skills grow, he or she is able to get an increasingly specific history of the disease. He or she then deals with the elements that relate directly to the session's theme or objectives. How does the patient feel about someone so young? What are the patient's expectations? What does the patient find difficult or possible to accept from a future physician? What does the student take away from this?

### *Diary*

The meeting with the patient is followed up with a period of personal reflection on the activity, using the diary for structure (Lacombe, 1991a; Lacombe B. et al., 1992). Even if the student acts only as the observer, he or she must make entries after each session in the diary appended to the guide for each stage. In addition to instructions and explanations, it contains two pages that must be filled out for each session. The first page is "public" because its contents will be discussed with the group. The monitor can read this page and comment on it; the student uses it primarily to record notes relating to the skills needed to recognize the contents communicated by the patient that the student must interpret. It should reflect the various levels of communication content and messages relevant to understanding the patient's situation. The monitor signs off student participation but does not record a grade. The monitor's enabling role must take precedence over critique.

The second page is "private". This is the diary proper and its contents may be discussed with the group or monitor only if the student wishes. The student uses this page to record notes about private or personal aspects, communication, his or her personality, and performance. The fact that the contents need not be presented to one's peers facilitates self-assessment. The student also records any information that might help him or her assimilate the experience and evaluate progress.

### *Plenary*

After completing the entries in their *diaries*, students meet with the monitor. The student is invited to present the reason for his or her patient's consultation as well as the history of the patient's current complaint. The relevance and accuracy of the vocabulary are examined to determine the meaning of the information collected. Each student is requested to emphasize the interesting or difficult aspects during the interview. The monitor shares his or her own difficult experiences with the group; the entire group offers support and interpretations.

### *Role-playing*

Now is the time for role-playing. A volunteer plays the role of the patient; another, that of the physician. The monitor occasionally plays one of the roles. Each player receives a short outline describing the role. The simulation never lasts more than 10 or 15 minutes. Each student watching has an *interview observation grid*. Looking on role-playing is a good

opportunity to observe communication "directly", perceive the related difficulties, analyze them, and correct them as a group.

Sometimes a number of scenes are played in order to illustrate variations on a theme. At the end of the scene, the "patient" describes the embarrassment that he or she felt, the difficulty in using medical vocabulary, and so on. The student that played the role of the physician likewise provides analytical feedback. The monitor and the entire group react and ask questions. Everyone analyzes the quality of the interview and the attitudes that it brought out.

### *Exploring the theme*

Then the group goes back over the required reading and past experiences. The role-playing and the ensuing discussions last about one and a half hours.

### *Simulated patients*

Simulated patients are used instead of real patients for certain communication sessions. They are trained to play roles illustrating communication difficulties relating to the patient's personality or delicate clinical situations: alcoholism, sexually transmitted diseases, aggressiveness, and so on. These "patients" provide students with feedback on what they felt, on what makes communication difficult, and on their expectations.

*A typical session in collection and presentation of clinical information (stages I and II)*  
Every other week, the session is devoted to *collection and presentation of clinical information*, which relates specifically to the system being studied in the concurrent PBL unit. As with *communication and humanism*, students are required to consider the objectives given in the guide and to reflect on their personal experiences.

### *Revision*

This part of the session is used to review physical-examination maneuvers from the preceding session. The monitor responds to points on which the students are unclear.

### *Role-playing*

This is followed by an exploration of the symptoms relating to the system being studied in PBL: evaluating either the main symptom or the history of the current disease. The patient must present with one of the pathologies encountered in tutorials during the preceding two weeks. The monitor can play one of the roles, such as the physician, enriching the clinical presentations from his or her own experience. A student usually plays the role of the patient, selecting the pathology to be presented with the help of the monitor. When a student plays the role of the physician, he or she must also explore the main symptom and seek out elements in the history that will make it possible to distinguish between the possible pathologies. After several minutes of interviewing, the "physician" summarizes for the patient the features and evolution of his or her main symptom, keeping in mind the structure for exploring the proposed symptoms. The interview then ends.

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When providing analytical feedback on the role-playing, students discuss the questionnaire and the choice of symptoms with respect to the pathology being studied. Over the next half hour, the students and the monitor look back over the terms used by the patient to convey his or her symptoms. Then, they discuss the features that allow them to distinguish between the different pathologies. They try to determine which pathological process affects the structure or organ. They review the quality of the interview and the attitudes that come out during it.

#### *Demonstrating the physical examination*

The monitor takes his or her turn at demonstrating, in step-by-step fashion, how to perform the physical examination. Each maneuver is explained and "dissected"; the monitor explains the meaning of each and demonstrates how they all contribute to identifying the features being sought out.

#### *Practicing new maneuvers with peers*

All the students practice the new maneuvers for the next hour and a half. They take turns in the roles of patient, physician, and evaluator under the watchful eye of the monitor, who may intervene at any time with comments, suggestions, or should a difficulty arise, with a demonstration.

#### *Integrated diagnostic process (Stages III and IV)*

During Stage III, which occurs in the second semester of the second year, the students in their groups of eight continue to practice the diagnostic process every week or learn about specific aspects of medical intervention by practicing interdisciplinarity, palliative care, the male and female genital examination, the rectal examination, dermatological assessment, sexual-function assessment, or doing investigative work in the hematology laboratory.

During this phase, the sessions on *communication and humanism* are fully developed, integrating the medical history and the complete physical examination into a clinical process for diagnosing and solving problems. At the same time, emphasis is placed on the quality of communication with the patient and other health-care professionals. The students assimilate this new approach, showing greater concern for the patient and remaining non-judgemental about his or her comments.

After the demonstration, the monitor reviews sample medical histories and physical-examination reports with the students. Emphasis is placed on concise language, accuracy, the use of sketches, or effective written communications.

Establishing the list of problems implies a ranking that takes into account the most relevant features while respecting patient expectations: is the pathology life-threatening, immediate, or short-term? Is the risk major, immediate, or short-term? Is the disease potentially curable? Does the pathology require no intervention?

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During the next session, students will finally, for the first time, write up a medical history and perform a complete physical examination on their own. This is difficult to complete in two hours. As students do their write-ups, they become aware of their shortcomings and draw up the list of identified problems. The monitor then corrects their reports in detail.

Each student must present his or her "patient" to the group. This is a difficult step because the students must adhere to the SOAP (Subjective, Objective, Assessment, Plan) approach. Depending on the specific, pertinent elements, the monitor reveals the processes and the learning difficulties. The monitor may decide to simulate integration by guiding the student through the steps in differential diagnosis. Diagnostic and treatment interventions receive greater emphasis in Phase IV.

#### *Specialized session (Phases III and IV)*

Some of the sessions during these two phases are devoted to mastering specialized clinical skills.

##### *The breast examination*

One of the sessions in the fall of the second year is devoted to the breast examination. In a large-group session, a teacher reviews of the components of the medical history and physical examination that relate to breast evaluation, breast self-examination, examination by the physician, and recognition of specific disorders. Students take turns practicing the examination under the guidance of female "teaching patients". In a meeting that lasts three hours, two female teaching patients explore the symptoms related to breast disorders with the students. They discuss the embarrassment and anxiousness related to this type of evaluation. They demonstrate the breast self-examination, then the breast examination per se, with one of the teaching patients serving as the "patient". Afterwards, a student must perform a breast examination and teach self-examination to one teaching patient under the watchful eyes of the students and the other teaching patient. This occasion provides an opportunity to approach the topic of sexuality and the risk of misunderstanding or seduction inherent in this examination. This activity to help students to overcome the difficulties relating to the intimate nature of this examination.

##### *Male and female genital examination*

The genital examination is likewise taught by male and female teaching patients. The presentation that begins with a discussion of the physician-patient relationship in this specific context and the various psychosexual problems associated with genital evaluation (interpretation, risk of seduction, aggression, and so on). This is followed by a simulation that allows students to explore specific symptoms. A teaching patient reviews the basic and physiology involved. One of the female teaching patients performs a manual examination of the external genitalia as well as an examination using a speculum on the other female "patient". The teaching patients then comment on the feelings or interventions that bothered them during the examinations. The students then take turns, in groups of eight,

practicing the complete genital examination on one of the female teaching patients while the other looks on.

This type of teaching, used as well for breast and male-genital examinations, has worked quite well since 1988. This preparation is now a well-instated part of our faculty culture.

#### *Exploration of the sexual function*

In groups of eight under the supervision of two sexologists, the students use role-playing to explore sexual function as described in the required reading. The importance of this evaluation in the prevention of sexually transmitted diseases is emphasized. The uneasiness encountered during this exploration, especially in situations of seduction or interpretation occurring during the role-playing, is revisited.

#### *Palliative care*

The students devote two entire sessions to palliative-care interventions. The readings stress an adaptation to the disease and the patient that is specific to the situation. The multidisciplinary team can be of tremendous help, especially after meeting with terminally ill patients. The specific learning objective is to define all the problems relating to patient comfort rather than to specific treatment for a disease. This activity provides an opportunity for many students to express the problems that their families experienced when one of their relatives was faced with a terminal illness.

#### *Integration during Phase IV*

Phase IV of the clinical skills learning unit occurs during the fall of the third year. It fits into the multidisciplinary units. Over a 12-week period, students explore problems affecting various systems (See Table V). In addition, training in the diagnostic process is rounded out in this phase with formal sessions on pediatrics, geriatrics, and interdisciplinarity.

In order to better integrate the cognitive dimension to clinical skills and the diagnostic process, the multidisciplinary unit mentor (Unit 14) serves as a clinical monitor during this phase. Accordingly, each group has two mentors that accompany the students on the cognitive and clinical planes. During this phase, the monitor is in attendance for every medical history and physical examination; he or she also provides feedback. The monitor is just as interested in the relationship aspects as in the medical history and physical examination. While the sequence is the same as in Phase III, emphasis is placed on the diagnostic process and differential diagnosis.

#### *Continuous chart*

The information-collection session entitled *Denver and Independence, continuous chart* (Lacombe, 1991b; Lacombe, 1992b) is carried out individually. At the beginning of Phase I (third session in January of the first year), pediatricians and geriatricians give a class demonstration on evaluating a child and an elderly person. The pediatrician explains the

features of the pediatric interview and the assessment of psychomotor development (using the Denver (Frankenburg et al., 1992) screening test) and growth (based on height, weight, and head circumference). Similarly, the geriatrician uses a video to illustrate the components in interviewing the elderly and in assessing independence (with the SMAF (Hébert et al., 1988) grid) and intellectual functions (abridged Folstein mental test and the 3MS (Hébert et al., 1992)). In the two years that follow, students will have to perform these examinations on a child under the age of four and an adult over the age of 65 from within their circle of family and friends. This enables them to acquire a prospective vision of health and growth.

### *Pediatrics*

The two sessions on pediatrics is led by pediatricians; it covers neonate examination, examination of the hospitalized child, and interviewing parents. The pediatric aspect of the *continuous chart* of each student is reviewed by the monitor and the group.

### *Geriatrics*

One of the sessions on geriatrics deals with the complete evaluation of an institutionalized, chronic-care patient, including examination techniques specific to elderly patients who are immobilized or uncooperative. The second focuses on the evaluation of a patient seen in a short-term geriatric unit, the focusing on the evaluation of higher-function independence. This time, the student must work with a member of the multidisciplinary team. The student must then present his or her "patient" to the multidisciplinary team.

### *Evaluating learning*

Both formative and summative evaluations of the student are carried out during the entire clinical skills learning unit.

### *Formative evaluation*

Formative evaluation of the "personal-control" type in each phase enables students to measure the achievement of objectives based on predetermined grids comparable to those used for the summative examination: interview evaluation grid (Stage I); symptoms exploration grid (Stage I); and symptoms exploration grid, risk-factor grid, and systems review (Stages II and III). Moreover, the communication diary (Stages I and II) serves for evaluation to the diagnostic-process guide (Stage III), and the evaluation grid for physical-examination techniques (Stage I).

There are many opportunities in the course of the phase for feedback on an evaluation of student progress. The session towards the end of the phase is devoted to reviewing and evaluating the achievement of all the objectives targeted in the upcoming summative examination.

*The summative evaluation*

The summative evaluation focuses on the following elements.

- Attendance and participation in sessions: students receive their attendance records at the beginning of each phase. They must be signed by the monitor after every session. Students must participate in a minimum of 80% of the sessions in each phase in order to be eligible to sit the exams at the end of the phase.
- Objective examination in each phase consists of open short-answer questions or problem-analysis questions. All of the learning objectives from all stages up to that point are covered.
- The objective structured clinical examination (OSCE) is given at the end of each stage. This examination covers two fields and involves the same evaluation grid as formative evaluation. It consists of 16 to 18 four-minute stations, each involving a series of specific measurement criteria. All of the learning objectives from all stages up to that point are covered. Student grades vary from 84% to 87%.
- Objective evaluation of history-taking and physical examination on real patients is carried out in Stages III and IV.
- Monitors carry out the evaluation of continuous chart contents in Stage IV.
- Monitors provide overall assessment of the professional attitudes and quality of work with patients in Stages III and IV.

The methods used for formative and summative evaluation are closely tied and cumulative. Knowledge is tested using open short-answer questions and problem-analysis questions; know-how and attitudes are evaluated with an objective structured clinical examination.

Faculty monitors are not involved in summative evaluation in Stages I and II. They are, however, called on to provide written feedback to students experiencing difficulties.

During Stages III and IV, the diagnostic process monitor writes up an overall assessment for each student, stating their progress and difficulties, as well as a criteria-based evaluation of history-taking. The promotion committee (See Chapter 8) gives very close consideration to borderline cases, going beyond simply looking at grades when considering students for annual promotion.

Evaluation weighting differs from one stage to the next. In Stages I and II, 50% of the student's grade comes from short-answer and problem-analysis examinations, while the other 50% comes from the objective structured clinical examination. The final grade in Stages III and IV consists of 30% for the objective structured clinical examination, 30% for the criteria-based history-taking evaluation, 30% for short-answer and problem-analysis examinations, and 10% for the monitor's assessment. Passing grades in all four methods of evaluation must be obtained in order to get an overall passing grade in Stages III and IV.

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## Features of Clinical Skills and Program Reform

The reform of the MD program at the University of Sherbrooke aims at promoting training that is centered on the student, attentive to the needs of the community, and characterized by humanism in order to deliver health care that is centered on the patient (See Table VI). One might be tempted to see humanism as being the most important feature of the clinical skills learning unit. But while this aspect is of great significance, the unit focuses on each of the major and distinctive program orientations.

### *Practicing patient-centered medicine*

Many elements in the clinical skills learning unit are designed to foster the practice of patient-centered medicine (Lacombe G. et al., 1992): early contact with patients, the patient as a learning resource, and teaching/evaluating patients.

### *Early patient contact*

As medical competency increases with knowledge of pathologies, one might be led to believe that the patient should take a back seat. Physicians making this assumption tend to see their role as being centered on diseases. To offset this tendency, the clinical skills learning unit develops responsiveness to the patient through early contact with patients. Patients become interesting in themselves as "sick people", instead of just being vehicles for an "interesting disease". Of course, this contact remains medical in nature. Nevertheless, the clinical role models presented foster this view of the patient and demonstrate it on a daily basis in professional practice.

### *The patient as a learning resource*

Throughout the diagnostic process in the second year, students must learn to recognize instances of not having the right knowledge or having the wrong knowledge as revealed through the history-taking and physical examination of the patients assigned to them. They must also remedy the situation in order to move forward to differential diagnosis. The patient-not the history or the PBL problem on paper or in a video-becomes the focus and even the stimulus for learning. Students must find in their patients the pertinent information that will nourish their learning.

### *"Teaching" patients*

Patients in contact with health-care interveners go through difficult experiences. Certain examinations are inherently sources of anxiety. Patients need to be respected and they expect a great deal out of the relationship with the physician. Why can they not tell the students this directly? Can patients not directly teach students how the physician should approach them, interview them, and examine them? In the initial session, a physician teaches the theory relating to breast examination and to male/female genital examination. Then, the physician introduces real patients who, in accordance with standards, act as teachers. These individuals are trained to identify the technical and relationship difficulties experienced by the students. We must recognize this untapped resource that medical educators traditionally do not have.

Table VI: Features of the longitudinal clinical skills unit

1. Definition of specific objectives reading to clinical performance and behavior.
2. Method fostering the development of humanistic attitudes
  - Experiential model that takes into account previous experiences
  - Diary used as deepening tool
  - Extended contact with clinical role models
  - Clearly stated objectives and directed readings
3. Structure facilitating integration at many levels
  - Transversal integration
  - Complementary with PBL units
  - Vocabulary, activities, and monitors common to both fields of activity (clinical skills and information collection)
  - Longitudinal integration
  - Recall of preceding objectives
  - Versatile monitors
  - Evaluation
4. Patient-centered teaching
  - Early contact with patients
  - Patients as sources of complex or vague problems
  - Faculty patients participate in breast examination and mail/female genital examination
  - Patients evaluate the physician-patient relationship
5. Student-centered teaching
  - Previous experiences taken into consideration
  - Personal growth through progress of contact with situations of increasing difficulty and/or of increasing emotional burden, with peer and role-model support
6. Community-centered teaching
  - Theme that stresses responsiveness of physicians to the needs of the community
  - Management of a child and an elderly person in the community for two years
7. Evaluation using a variety of methods to identify aspects requiring improvement
  - Questionnaire filled out by each student after each stage and about each session
  - Evaluation meeting with the monitor
8. Evaluation using a variety of methods to specifically measure knowledge, the physician-patient relationship, and clinical performance

*Patient evaluators*

In the sessions on communication, when using OSCE-type evaluation, history-taking, or a complete physical examination, patients evaluate students and assess the quality of their work.

*Training that is responsive to community needs*

Program reform focused less on *community needs* than the other aspects. Our resources and creativity appear to be more limited, despite the fact that our society has made tangible progress in this regard, especially since the creation of the Quebec network of local community services centers (CLSC). The social dimension of health care in Quebec has developed significantly in the last 25 years. No one, however, claims that the medical profession has kept pace. Health-care reform has subjected physicians to budgetary constraints and administrative control that are seen as persistent threats to the development of medical science, the quality of specialized care, and professional power.

We wanted the MD program to be responsive as a whole to the current demands of Quebec's society. Accordingly, physicians should learn to be better communicators, to be able to work in multidisciplinary teams, to be receptive to patient feedback, and to be able to ask patients more questions about their sexual life and intimacy. This last point presupposes that the physician can distinguish between a professional relationship and one of seduction. During the course of the clinical skills learning unit, students acquire a greater understanding of community needs through the continuous chart on a two-year-old child and an elderly person. Students also become aware of the type of response offered by the family, the community, and health-care services. Students discover that certain information is only available "in the field".

*Training characterized by humanism*

Chapter 6 provides a detailed description of the components of medical humanism that we would like to see students absorb through the training program.

Attitudes are often likened to knowing how to act. According to Spafford, Pesce, and Grosser (Spafford et al., 1998), an attitude is a "disposition to behave favorably or unfavorably toward some object, person, event, or idea. An attitude has emotional and cognitive components. Examples of emotional components of an attitude would be love and hate; examples of cognitive components might be favorable biases and prejudiced opinions". According to this behaviorist definition, attitudes can be established and organized through learning. Like problem solving and learning skills, they can even be linked to a specific context. Since we are particularly concerned with the impact of attitudes, we would like our physicians-in-training to demonstrate attitudes of respect, integrity, and responsiveness to the patient when faced with a challenging situation.

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Gagné (1985) acknowledges three components in attitudinal training: cognitive, affective, and behavioral. On the cognitive level, being aware of the expected behaviors and their underlying justification can enable self-criticism and the perception of certain incongruencies. On the affective level, feeling at ease or ill at ease in doing something affects the development of certain behaviors. Acknowledging feelings can influence the physician's choices, and provides him or her greater control over his or her conduct. The "with respect to..." feeling can change. Finally, on the behavioral level, the manifestation in a concrete situation may not necessarily be the same as that taught. The transmission of values or the rules in a code of ethics still has a role to play in the acquisition of attitudes. "Moral education" would be one component whose basis must be linked, according to Gagné (1985), to concrete situations.

Obviously, we would like to instill the highest level of humanism possible in all future physicians. Nevertheless, the moral maturity of the individual student plays a significant role in the acquisition of attitudes. In some cases, the process can be long; two years of learning may not be enough. Knowing the objectives, the justification, and their specific contents, however, enable students to get their bearings and to take responsibility for their actions by increasing their motivation to change if the setting requires it.

#### *The experiential method*

Our society does not dictate the values, attitudes, and behaviors that the public, patients, and health-care professionals expect from physicians. Inculcating these values is more difficult than conveying knowledge. Simply teaching rules of conduct or a form of moral code would not be very effective. Our experience has shown that persistent prejudices on the part of students even impede the acquisition of factual knowledge. We have strategically decided to allow students to construct their own "reference model" based on their own reflections, feelings, and experiences. To a great extent, our activities are modeled on a modification of Kolb's (1975) experiential model.

Based on this experiential approach, the student begins by experiencing a real situation. This is followed by a period of reflection on the experiences, including past experiences. The third step consists in identifying known principles that can be applied to new experiences in the fourth step.

All the conditions for learning attitudes can be blended into activities organized according to this experiential model, which offers students opportunities for self-assessment, formative evaluation, accountability, and personal development. The student recognizes the signs, symptoms, and medical maneuvers from the preparatory readings either in his or her own experience or in his or her family.

#### *Student-centered training*

Student-centered training refers to an educational model that contrasts with a traditional

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curriculum structured to convey the teacher's knowledge. Our rationale in opting for learning by and especially for the student was to enable students to develop their independence by allowing them to define their own learning objectives, evaluate their own performance, and to identify any necessary corrective action.

For the most part, the clinical skills learning sessions have specific objectives. Students know what is expected of them; it consists of elements essential to their future practice of medicine. On the other hand, we allow students to set their own sub-objectives in order to meet personal learning needs. Examples of this are correcting weaknesses in history-taking, in performing the physical examination, in communication, or even in dealing with certain emotional problems related to learning.

Autonomy refers more to the "direction of learning" than to specific aspects of medical life. Certain complex situations elicit emotions that limit one's capacity to intervene. In the case of clinical skills, one would speak of emotional maturity rather than autonomy. While these concepts are difficult to separate, the objective remains the same: promoting personal growth so that the student can develop the capacity to perceive his or her shortcomings and strengths, and to be able to set realistic, attainable objectives.

We have selected tools that enable students to integrate, without supervision, increasingly complex elements into their evaluation. Students value their degree of autonomy using the SMAF measurement system (Hébert et al., 1988). This measurement is similar to the mental assessment of the patient based on an abridged 3MS or Folstein test (Hébert et al., 1992), to which students add missing elements by carrying out a more exhaustive evaluation. The structure is simple, easy to master, and promotes a feeling of increasing competence.

We strive to prepare students to respond better to the stress resulting from specific situations by integrating the clinical content into the theoretical problems studied. We give them the opportunity early on to become aware of their practical difficulties. It would be a shame for a student to discover after four years of hard work that he or she hated having contact with patients or with other health-care professionals. It would be equally regrettable to realize belatedly that one cannot tolerate illness, nudity, suffering, or death. The clerkship is already quite late to come to such a realization. It would be better to face it earlier under circumstances that offer support and the possibility for adaptation. The series of clinical situations associative with the various levels of stress (Coburn & Jovaisas, 1975) are dealt with during activities for learning clinical skills.

We have developed activities that require the student to acknowledge the patient and his or her life. They demand that the student view the patient as a human being rather than a "homeostatic machine to be maintained", "carrier of a disease to be cured", or even "death, which must be hidden or pushed back at any cost". This special contact forces students to see themselves in their patients. As a result, we feel that students will be responsive to

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patients and to the community. In addition, they will be more autonomous and show greater maturity if we provide them with the opportunity to discover in themselves the physicians of tomorrow...and perhaps tomorrow's humanistic physicians.

## Implementation Hurdles and Persistent Challenges

All medical schools have their own traditions and cultures. Although still young, Sherbrooke is no exception to the rule. The Faculty of Medicine is completely integrated into the university hospital; in fact, its offices and classrooms adjoin clinical facilities.

### *The Faculty's mandate*

In 1984, the GPEP Report (Association of American Medical Colleges, 1984) recommended that medical schools place as much emphasis on the acquisition of skills, values, and attitudes as on knowledge. A Reform Framework Committee (See Chapter 2) determined that the clinical skills learning unit should ensure that students acquire attitudes that would enhance the physician-patient relationship. As a logical extension, this could continue throughout preclinical training. Some sessions would relate directly to PBL units. Others would reach beyond traditional skills in performing histories and physical examinations. Their main objective would be to prepare students to play active roles in the health-care team as early as the third year, as a result of emphasizing that the physician-patient relationship should be of the highest quality.

In April 1987, the Clinical Skills Development Committee was formed, just eight months before the launching of the future clinical skills learning unit. Through the diversity of their professional and teaching experiences, the Committee members, who were also experts in the area of content, relevance, or method, proposed that the Committee take in hand the learning of clinical "skills", know-how, and attitudes because they cannot be acquired through theory.

The Committee began by exploring theoretical needs. The Faculty Administration presented problems encountered in teaching semiology and premedical propedeutics under the old curriculum. Then, the heads of the clerkship rotations for each clinical department were invited to categorize objectives and to separate those that should be handled in the clinical skills learning unit from those that should be dealt with during the clerkship. A framework of specific objectives was proposed in June 1987. It was already evident that simply reorganizing existing activities would not be enough. The new objectives called for new teaching and evaluation methods. Since there would be less time available for clinical teaching than under the old curriculum, it meant that each activity would have to be even more efficient in order to establish complementarity with the PBL units.

*Responsibility for teaching clinical skills*

Communicating, taking a medical history, and performing the physical examination are arts that all physicians must master. Yet none of them takes precedence over clinical skills. Similarly to the fragmentation of clinical life into many subspecialties, in an academic health center, each clinician has his or her own limited field of specific clinic expertise and responsibility. At Sherbrooke, even departments that would be good candidates for integration, such as internal medicine or family medicine, have already been extensively committed with the implementation of PBL. Both internal medicine and family medicine are involved in many units. These departments organize the clinical immersion rotation and PBL community rotations as well play a role in the clerkship rotations. Internists, who have become the most versatile and integrating group of teachers, have taken charge of the multidisciplinary unit (Unit 14) in the third year. No other clinical department had the will or the capability of taking on the burden of clinical skills learning activities. Consequently, it had to be a Faculty task. Although our matrix management system (See Chapter 2) promotes the taking of responsibility, the lack of a sense of belonging has greatly impeded clinical contributions, since few have recognized the need to act collectively.

*Training monitors in communication and humanism*

We perceived the notion of "role model" as being essential to fostering the acquisition of attitudes. The role model that we were looking for would be experienced and recognized by his or her colleagues as a competent, very humanistic clinician. From each clinical department, we picked monitors who were also teachers involved in graduate training in order to ensure continuity in training. These clinicians were to demonstrate the same focus on humanism and use the same vocabulary. The message could be sent out to the whole Faculty by rotating a few of the teachers on the team each year. This process would also enable us to train quite a few monitors. The family medicine department took charge of half of the groups; each clinical department assumed responsibility for at least one group of eight students per year.

At the outset, our clinical "experts" in communication did not have very much theoretical knowledge about the subject. In response to specific needs expressed by monitors, the Clinical Skills Committee organized training sessions, mostly with the help of teaching psychiatrists.

Small-group psychology, communication theories, role-playing production and direction, working with simulated patients, conducting an interview in front of a mirror, using the diary, and reviewing session contents all figured into the training. This early training enabled us to identify the contents for overall training for new monitors. This procedure allows us to develop a stable core of interested monitors who were to spearhead the clinical skills teaching program.

*Training monitors in the collection and presentation of clinical information*

Since we decided to promote longitudinal integration and progressive evaluation of skills, we looked for versatile monitors who were amenable to teaching vital signs, neurological examination, musculoskeletal examination, or cardiac, respiratory, abdominal, and even fundus propedeutics. It took several years, however, before most groups had the benefit of this type of teacher.

Attempting to standardize the teaching of history-taking and the physical examination posed a particular problem. While, on the one hand, none of the monitors felt really competent to teach communication, the clinicians saw themselves as experts when it came to teaching the physical examination. In fact, they saw no need to take part in training or standardization sessions. That is why less than 30% of clinicians attended, despite the need repeatedly expressed by students.

*Diagnostic process*

The reduced number of sessions during Phases III and IV led to a significant decrease in the number of complete histories and physical examinations performed by the students in the new program.

The irregular contact between the monitor and the students during Phase III also created significant malaise. The monitors could not remember student performance and therefore often provided feedback too late to be really effective. The concurrent specialized sessions (genital examination, palliative care, prevention of infection, practicing venipuncture, and so on) added to the problem. A number of changes were implemented to review the main signs and to respond to students' doubts: breaking up into subgroups with a single monitor and a follow-up visit once the student had completed his or her work with the patient.

Reorganizing an intense period of practice (complete medical history, physical examination, and investigation) into an integrated process at the end of Phase III (at the end of Unit 14) was also problematic. As with the physical examination, it was difficult to modify the habits of monitors, who felt that there was no need to observe the students since they could evaluate performance from the write-ups of the physical examinations. Moreover, since the monitors had their hands full with training, they had a hard time recruiting patients suitable for teaching, especially since the clientele in tertiary-care facilities heavily loaded and there were not many teaching hospitals.

*Availability of patients*

There were fewer and fewer patients available, whether for *communication and humanism*, starting in first year, or for the diagnostic process, up until third year. Consequently, we had to increase the number of sessions with simulated patients and role-playing as well as make use of other teaching centers in the community. Regardless, patients remain key players since, whether real or simulated, they cannot be replaced

### *Logistics*

The clinical skills learning unit ran for two years without interruption. The designation of individuals in charge of the stages enormously improved teacher assignment/integration and identification with the designated small group. The complementarity between all clinical activities and the other units in the preclinical phase continued to grow. The sharing of objectives by the pre-clerkship, two immersion rotations, and the four parts of the clinical skills learning unit had an undeniably positive effect.

### *Unit evaluation*

From the first year of the new MD program's implementation, a set of evaluation instruments (See Chapter 11) was adopted in order to identify weaknesses in the clinical skills learning unit.

Each student had to fill out a *Likert-type questionnaire* at the end of each stage. The questionnaire consists of 75 to 100 statements concerning general aspects of the stage (how activities were run, objectives were concise and achieved, monitor quality, preceding stages, and so on) as well as on the more specific aspects of each session (content, relevance, time allocated, and so on). The same procedure was used for the regular steward meetings. In 1992, the unit evaluation outcomes varied from 4.0 to 4.2 out of 5.

Students appreciated some activities more than others, such as those taught by teaching patients (breast examination: 4.8; female genital examination: 4.7; male genital examination: 4.3); difficult situations (palliative care: 4.3; sexual evaluation: 4.3); and techniques (urinary catheter: 4.3; venipuncture: 4.5).

As a result, major improvements were implemented. For example, correct observation boosted the assessment of Stage IV from 3.9 to 4.2. Similarly, the introduction of simulated patients pushed the rating of difficult communication sessions from 3.4 to 4.1.

The *summary report* produced at the end of each meeting is a source of students suggestions and enables us to identify weaknesses and strengths. Unfortunately, such reports are often late in coming.

Certain aspects of *student evaluation* testify very eloquently about unit performance. To illustrate, cumulative objectives allow us to see if there has been progress from one stage to the next through the objective structured clinical examination. The performance on aspects of the neurological and abdominal examinations shows improvement from Stage I to Stage IV, as does performance on vital signs. This was not the case with the musculoskeletal examination until 1991 when more detailed documentation was provided during the Stage I sessions. These new conditions probably enhance the structure of knowledge required for performance in these areas.

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Most of the students from the first cohort filled out the *clerk questionnaire*. This survey's findings emphasize the importance of the components of *communication and humanism*. Eighty-five percent of respondents indicated that they regularly use the notions acquired during the communication sessions.

The evaluation system for the clinical skills learning unit enables us to identify certain strengths and weaknesses. The latter are being gradually resolved. Certain aspects will require additional resources (patient contact, simulated patients); others call for an organizational review, especially in the case of the framework for Stage III. Prioritizing the modifications has been proven difficult given the many constraints on faculty members as well as a lack of time and space.

## Conclusion

We are completely convinced that the clinical skills learning unit is congruent with the major thrusts of the MD program reform. This unit probably stands out as the activity that most embodies our humanistic objectives. It reflects a genuine concern for student needs. The community emphasis, expressed somewhat originally in the continuous chart, could be gradually strengthened over the years.

The framework for learning clinical skills is characterized mainly by the progressive acquisition of attitudes, communication skills, and examination techniques that are increasingly complex in nature. The learning fits into a professional process that is mainly diagnostic at this level. Activities are arranged to promote the maximum contact with patients but only with respect to interventions for which students have already received basic training. The patient therefore does not suffer from contact with students. In fact, the respect with which they are treated often enhances their cooperation. Teaching patients and simulated patients reinforce the importance given to the sick in training future physicians.

The participation of all departments in teaching communication and humanism undeniably contributes to the development of a faculty culture that will provide continuity in the area of the physician-patient relationship between preclinical training objectives and the clinical reality experienced at the graduate level. The creation of activities designed to strengthen this continuity responds to a need currently expressed by a number of clinicians. The development of more structured training for monitors will help them increase their competence in these areas.

A number of limitations and difficulties related to this approach cropped up along the way. The central role that this type of learning plays in all aspects of integration, knowledge of different disciplines, clinical sciences, and humanistic behaviors makes the creation of a supradepartmental structure mandatory. This kind of structure would make it easier to

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mesh the clinical skills learning unit with all of the PBL units. Developing a group of versatile monitors who would take part in both *communication and humanism* and the *collection of presentation of clinical information* activities would provide for the formative evaluation of students and the screening for students in difficulty. Evaluating attitudes, humanism, and the diagnostic process will require special attention.

Renewal of our program will help upset the feeling of comfort that too often accompanies clinical teaching during the "preclinical" period in medical training. What with the reduced amount of time for training and the increase in knowledge, there is no place for unplanned acquisition, through simple contact, of communication, interviewing, and examination techniques practiced at the patient's bedside. New dynamics are setting in, both on the pedagogical and clinical levels, translating a specific concern with the role of the teacher and that of the role model for attitudes and professional competence.

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## Student-Learning Assessment

Jacques E. Des Marchais, Robert Black and Nu Viet Vu

*Tell me your assessment methods and  
I will tell you how you teach*

From spring of 1986, the Framework Committee had been studying the problem of student-learning assessment. In-depth reform of the curriculum requires a no less significant change in the methods of assessing students. One observation stood out clearly from the first: we could no longer limit ourselves to measuring fact recall. Nevertheless, although it was recognized early on that we had to face the challenge of modifying assessment methods, this challenge was not met until the third year of planning, in January 1987, after problem construction.

In educational sciences, assessment is linked to learning objectives. These must be clearly defined and conveyed to the student. Afterwards, what is assessed is the extent to which the student has achieved these objectives. Now, in Problem-Based Learning (PBL) students themselves identify a certain portion of the objectives. Naturally, these therefore are liable to vary by group and indeed by student. One challenge was to find how to adapt assessment to a context in which teachers are not the only ones determining the material to be taught.

To assess is to assign a value to something. What dimension should the new program privilege? Memory? Interpretation of data? Problem analysis? Problem solving? Interaction among students? Humanism? Autonomy? Here was a further task that the planners had to tackle. We had to decide on the object of assessment (the what) and then measure it by means of the most valid and reliable instruments accessible (the how). The teachers' concern was about content validity, whereas the concern of those who spearheaded reform was to ensure the greatest possible consistency with PBL philosophy and methods.

What were the results of the summative assessments carried out during the four first years of program implementation? What value could be assigned to their validity and reliability? What was the performance of students in different units of the program, analyzed according to different assessment formats? What lessons could be learned from this first implementation phase?

## The Goals of Assessment

In January 1987, a special evaluation committee, aided by consultant Nu Viet Vu, was mandated to develop a new assessment system. The work done by this committee resulted in a document called *L'évaluation des apprentissages des étudiants* (Faculty of Medicine, university of Sherbrooke, 1987) (student learning assessment), which was approved by the Council of the Faculty in August 1987, just four years before the official start of the new program. This document set forth the justification for summative assessments and their objectives, and it described how they were carried out during the first year of implementation and presented guidelines for subsequent years. As well, it addressed assessment to be done by tutors.

## Justification for the Assessments (the Why)

The changes proposed to the summative assessment system and justification for those changes were based on a series of whereases (Table I) and conditions (Table II). These whereases and conditions were to guide the development, during planning, of six recommendations integral to the reform initiative. The recommendations related to the why, the how, and the when of assessments. For all those working on the reform, one principle stood out clearly: all learning must be assessed, and assessment is an integral part of the role of the teacher.

Table I. The whereases of assessments

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1. An assessment that is consistent with the goals of the new program requires use of varied methods and techniques.
  2. All students must attain a criterial threshold of competency at the moment of their entry into postgraduate programs.
  3. All graduates must pass the comprehensive examination set by Quebec's faculties of medicine and should be able to sit the Medical Council of Canada's Qualifying Examination if they wish.
  4. Summative assessments implicitly guide the way the program of studies unfolds.
  5. Repeated and numerous summative examinations cause the learning environment to deteriorate by intensifying stress and excessive competitiveness.
  6. Assessment methods and techniques are determining factors in guiding student learning.
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Table II. The conditions underlying assessments

1. Many teachers have benefited from an education in teaching methods that makes them more likely to use different assessment methods and techniques.
2. The multiple-choice question examination format remains a valid and reliable technique for measuring the retention of factual knowledge, but is not very useful in measuring skills in problem analysis and clinical reasoning.
3. Criterion-referenced examinations have been in place in the Faculty of Medicine for some years; their acceptable performance level (APL) is determined beforehand using the modified Nedelsky's method.
4. The Faculty now has significant experience in using objective structured clinical examinations (OSCE).
5. Extensive research has been conducted on assessment in medical education and offers an incentive to take advantage of new methods.
6. For the time being, a pass-fail system cannot be put into place.

The Object of Assessment (the What)

The object of assessment (Table III) is based mainly on Recommendation 1:

*Every method of assessment must be consistent with the object of assessment so that the component concerned can be measured in a valid fashion.*

Four competencies must be mastered, falling in the domains of knowledge, know-how, and attitude: application of knowledge at various taxonomic levels, technical and clinical skills, self-directed learning skills, and professional attitudes and behaviors.

Skills related to applying knowledge include skill at acquiring, interpreting, and applying knowledge, and skill in analyzing clinical problems and solving them. Clinical and technical skills include skills related to patient interviews, physical examinations, and technical maneuvers. Those responsible for the program also wish students to acquire skills related to self-directed learning, which includes skill in self-evaluation and in developing and maintaining habits of continuing education. Last, professional attitudes and behaviors include communicative skill, intellectual integrity, and an empathetic and humanistic approach to patient management.

Table III. Objects of assessment

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**1. Measurement of intellectual processes (KNOWLEDGE)**

- Pure memorization
- Knowledge applied to basic and clinical sciences
- Clinical reasoning:
  - problem-analysis process
  - problem-solving process
  - decision-making process

**2. Measuring skills (KNOW-HOW)**

- Clinical skills:
  - interview
  - skill in physical examination
  - skill in technical maneuvers
  - presentation of a clinical history
  - chart maintenance
  - patient teaching
- Self-directed learning:
  - critical assessment of needs
  - identification of learning objectives
  - establishment of a personal program
  - research for information sources
  - critique of information gathered
  - assessment of learning accomplished

**3. Measurement of attitudes and interpersonal communications (ATTITUDES)**

- Responsibility
  - Relationships with peers, teaching staff, and paramedical staff
  - The physician-patient relationship
  - A humanistic approach to the patient
-

## Assessment Methods and Techniques (the How)

Assessment methods and techniques were presented mainly in Recommendation 2:

*In order to ensure consistency between the object of assessment and the methods for performing assessment, ten techniques can be used, according to the learning domain to be assessed. They are:*

MCQs	Multiple-choice questions. These consist of a statement and a choice of answers (the right answer and the traps).
OSAQs	Open short-answer questions. These consist of a statement followed by spaces in which the student can fill in the various parts of the answer.
PAQ	The problem-analysis question. This consists of the statement of a problem, a short clinical scenario, and one or more open-ended questions.
Structured oral examination	This is a test conducted in three steps. The student is presented with a problem and must first formulate hypotheses to account for it. She or he then has a set period in which to analyze and examine the problem, and then comes back to discuss the problem's explanation, and possibly its solution, with the teacher.
Tutor	The tutor accepts the responsibility for measuring a certain number of skills and expected student behaviors at the end of a unit.
Peers	Students assess their peers as regards the achievement of objectives and the procedure followed.
OSCE	Objective structured clinical examination. This test consists of a series of short stations, each of which comprises tests for which the objectives of clinical competency assessment have been predefined and structured in standardized fashion.
Logbook	The logbook is a notebook in which the student write what learning activities have been carried out.
Assessment grid	A grid of the items to be assessed.
Self-assessment	Students assess their own knowledge, skills, and behaviors as observed during medical learning.

We chose five types of assessment to measure these various competencies: written examinations, tutor assessment (Appendix 1), objective structured clinical examination (OSCE), peer assessment, and the structured oral examination. The logbook is also used during clinical-skills learning, and the assessment grid during clinical clerkships. There should thus be built-in consistency (Neufeld & Norman, 1985) between the object of assessment, the learning domains, and both formative and summative tests. The items presented in Table IV serve as indicators during problem-writing workshops and exam-question preparation.

Table IV. Fit between objects of assessment and measurement tests

LEARNING DOMAINS	FORMATIVE ASSESSMENT		SUMMATIVE ASSESSMENT	
	WRITTEN	BY OBSERVATION	WRITTEN	BY OBSERVATION
Intellectual processes Memorization of knowledge	MCQ OSAQ		MCQ OSAQ	
Application of knowledge	MCQ OSAQ	Tutor	MCQ OSAQ	Tutor
Clinical analysis and reasoning	PAQ	Self-assessment Tutor Peers	PAQ	Tutor-mentor OSCE Peers Oral exchange
Skills Clinical skills	OSAQ Logbook	Logbook	OSAQ	OSCE Tutor
Self-directed learning		Logbook Self-assessment Tutor Peers		Tutor
Attitudes and interpersonal communication Physician-patient relationship  Responsibility  Relationship with peers, faculty, and paramedical staf  Humanistic approach to the patient		Self-assessment  Assessment grid		Assessment grid

Written examinations consist of three kinds of questions: multiple-choice (MCQs), open short-answer questions (OSAQs), and problem-analysis questions (PAQs). MCQs should measure the student’s ability to acquire and remember specific facts and concepts. OSAQs should measure the ability to interpret medical facts, explain the principles and concepts related to a phenomenon, or apply them in a specific clinical situation. PAQs should measure not just the ability to interpret facts and apply principles and concepts, but also the ability to analyze information, formulate the most probable hypotheses, differentiate them, and verify them. A PAQ consists of a short scenario followed by one or several questions, sometimes organized sequentially, whose answers require analysis of the scenario’s components. OSAQs and PAQs make use of new clinical situations different from those to which students were exposed during tutorials.

Tutor assessment measures the student's skill at analyzing a problem, behaviors that promote communication during tutorials, expressions of humanism, and autonomous learning. OSCEs are a series of short stations lasting five to ten minutes designed to measure clinical skills and very specific techniques.

The goals of the written examinations and tutor assessments are based on Recommendation 3:

*Formative assessments should be favored over summative. In this way students will benefit from numerous opportunities to check the progress of their learning and to pursue their course with the guidance of positive or corrective feedback.*

as well as on Recommendation 4:

*Each unit of the program contains at least two formative assessment activities.*

With these considerations in mind, assessments devised with a formative goal should feature the same rigor as summative assessments when it comes to the validity and practicability of the measurement tests used. However, the sampling and length of formative tests can be more limited while theoretically preserving the same degree of test-measurement rigor. The results of formative assessments do not appear in student transcripts. They are simply a means for students to obtain maximum feedback and information on their progress (Guilbert, 1990).

### When to Conduct Summative Assessments Leading to Promotion (the When)

Since summative assessments are used for purposes of deciding on promotion, it is necessary to determine their timing as well as their number. Decisions on these matters are based on Recommendation 5: *Student promotion depends on a series of summative assessments: it will continue to be based on promotion by year, except at the end of preclinical training, which takes place in the middle of the third year of study.*

and on Recommendation 6:

*At the end of the first year, promotion will be awarded on the basis of grades compiled following four summative assessments: the first at the end of the orientation unit, the second at the end of the medical biology unit, the third in the middle of the second trimester, and the last at the end of the second trimester.*

*In the second year, three sets of summative assessments, the first in December, the second in March, and the last in June, will be used to accumulate grades which, along with assessments of the clinical skills unit, will be used to determine promotion to the third year.*

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This number of summative assessments was settled on with the following reasons in mind. When it comes to assessment and measurement (Neufeld & Norman, 1985), there must be enough measurement samples to ensure reliability. Teachers need to reliably verify student progress and the effectiveness of their teaching. Summative assessment activities are aimed to help students assess the progress made in their studies and attain awareness of whether they have mastered the learning objectives.

Promotion from preclinical training to the clerkship in the middle of the third year constitutes a critical moment when a judgement must be made regarding students' acquisition of competencies before authorizing them to undertake clinical training. At this stage, the need for a summative evaluation is all the more evident, in that the unit on multidisciplinary problems and phase 4 of clinical skills, occurring in the first trimester of the third year, are specifically intended to enable the student to integrate the concepts learned since the start of the program.

### The Weighting of Summative Assessments

The weighting of assessments conducted during preclinical phases in the first year, the second year, and the third trimester of the third year was determined in such a way as to assign a lower value to strict memorization and increase the prominence of analytical and synthetic procedures, while privileging learning that has taken place in tutorials during phases I and II (Table V).

In concluding, decisions regarding summative assessment respect the rules for assessment and promotion found in the *Règlement des études de l'Université de Sherbrooke*. This set of regulations allows for exceptions to be made in the MD program. These exceptions enabled us to make desired changes without having to obtain specific authorization from the university authorities. The new PBL program was thus able to accommodate itself to the existing system which made use of the grades A, B, C, D, and E. In the Faculty of Medicine, a grade of D fell within the range of  $\pm 2\%$  of a passing grade (determined beforehand), using Nedelsky's method for MCQs and Ebel's method (Livingston & Zieky, 1982) (subsequently adopted) for OSAQs and PAQs.

The adoption of new kinds of written tests (OSAQ and PAQ), assessment by PBL tutors, and modification of learning-domain weighting were all carried out within existing structures. Nevertheless, in implementing our intentions to modify assessments, we had to adjust to the existing university system. This frame of reference left us sufficient freedom to allow for the implementation of an innovative and rigorous assessment system likely to be well suited to the PBL context, in which learning objectives could vary by groups and by students.

Table V. Weighting of learning domains in summative assessments

LEARNING DOMAIN	PBL UNITS IN PRECLINICAL TRAINING		
	Phase I	Phase II	Phase III
Measurement of knowledge and its application <ul style="list-style-type: none"><li>• by means of MCQs and OSAQs: WRITTEN TESTS</li></ul>	50%	44%	27%
Measurement of ability to analyze and solve problems <ul style="list-style-type: none"><li>• by means of PAQs: WRITTEN TESTS</li><li>• by means of STRUCTURED ORAL EXAMINATION</li></ul>	30%	26%	13%
Skills measurement: <ul style="list-style-type: none"><li>• problem analysis and problem solving;</li><li>• contribution to communication and interaction in tutorials;</li><li>• self-directed learning, humanism</li><li>• as assessed by TUTOR or MENTOR</li><li>• as assessed by PEERS</li></ul>	20%	17%	30% 5%
Measurement of clinical skills and attitudes <ul style="list-style-type: none"><li>• as assessed by MONITOR and OSCEs</li></ul>		13%	25%

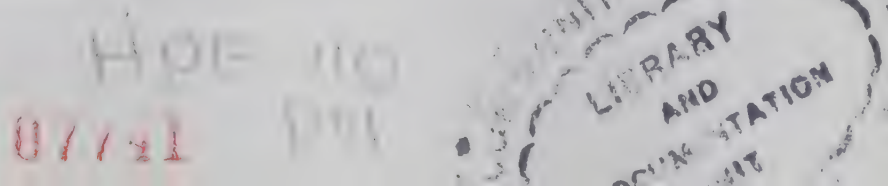
The Assessment Instruments

At this point, it is necessary to describe in greater detail the system of summative assessments and the types of tests and test results, and see how the system was gradually put into place over the first eight years of the PBL program’s implementation.

Summative assessments

During the phases of preclinical training, assessments take place three times a year: in December, March, and June. Each assessment relates to material learned in the preceding units. The way each unit is weighted for purposes of promotion depends on the number of credits it is worth. At the end of the year, a student must have passed each unit by reaching a predetermined level; tutor assessments are factored into the final grade.

A typical unit assessment consists of tutor assessments and three written tests, lasting a total of half a day: one MCQ test, one OSAQ test, and one PAQ test. In the third year there is also a structured oral exam. As for the longitudinal unit on clinical skills, it incorporates



four assessments over two and a half years; each of these consists of a written examination, an OSCE, and the monitors' overall evaluation.

The written examinations contain an average of 40 MCQs, 35 OSAQs, and 34 PAQs per unit in the first year and somewhat fewer in the second year. The correcting system grants one point per MCQ, two per OSAQ, and five to nine for each PAQ

*Problem-analysis questions (PAQs)*

The concern for consistency with Problem-based Learning made it necessary to measure students' skills at analyzing the principles inherent in the problems. To meet just this kind of need, McMaster devised the triple-jump exercise (Painvin et al., 1979). The more practical notion of conducting it in writing is what led us to formulate *problem-analysis questions*, or PAQs.

PAQs consist of a brief presentation of a clinical situation and components in the scenario that are left to the students to choose, organize, and interpret in order to analyze the problem. There follow several open questions enabling the student to demonstrate that she or he understands the problem (See examples in Appendix 2).

Over the first two years of implementation, the number of MCQs and OSAQs did not increase, though the program's administration insisted they should. In 1989-90, several teachers from each unit in phase II were invited to participate in a three-hour workshop to review PAQs and develop better ones (Des Marchais, et al., 1992). Over six different sessions, some 75 teachers-tutors took the training. The effect was noteworthy. The bank of 108 PAQ-style questions for the first year increased by 44%, exceeding 152 questions. The 70-question bank for the second year rose to 167, an increase of 138%. Moreover, this series of workshops led to the drafting of rules for building a PAQ (Table VI).

Table VI. Rules for building a PAQ

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STAGES IN PAQ BUILDING	
	<div>1. Choose a field, a subject, and a problem.</div> <div>2. Draw up the list of critical elements.</div> <div>3. Choose a relevant clinical situation.</div> <div>4. Write up the scenario.</div> <div>5. Formulate your question so that it contains an action verb.</div> <div>6. Draw up a list of the constituents of the answer.</div> <div>7. List possible answers, essential constituents, and incorrect constituents.</div> <div>8. Weight the question's constituents by assigning a number of points to each one.</div> <div>9. Go over the assignment of points for the whole of the exam.</div>

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## VERBS THAT HELP MEASURE ANALYTICAL ABILITY

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### AT IDENTIFYING A PROBLEM'S CONSTITUENTS:

identify, detect, rank, recognize, distinguish, discriminate.

### AT ESTABLISHING THE RELATIONS AMONG CONSTITUENTS:

compare, contrast, oppose, separate, link, correlate.

### AT ORGANIZING CONSTITUENTS:

deduce, justify, structure, organize, systematize, conclude.

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Building a PAQ presumes that the goal of the question is first determined in relation to the unit's objectives. Once the question's critical elements have been identified, the scenario can be constructed within a clinical context. A problem's critical elements constitute nodes in a sequence of concepts. The question must function in a revelatory way; for this reason it contains an action verb that leads to the analytical process. All that remains is for the teacher to determine possible answers and weight each of their constituents in order to assign a grade. A PAQ requires that the student carry out a three-stage procedure: identifying significant constituents of a clinical situation, searching for relationships between these constituents, and, last, decoding the situation in order to formulate the principles and concepts that explain the scenario's problem. In doing so, the student shows that he or she has passed through various stages of an analytical process.

Teachers have put forward some criteria for determining a PAQ's validity. If it is possible to answer the question without having to read the scenario through, or by simply dipping quickly into a reference work, it is definitely not a problem-analysis question, but rather one involving memorization. If the statement yields a series of very brief questions, most probably you are dealing with the application or comprehension level and not the analytic level. This holds good especially when questions are devised sequentially. Last, if the scenario leads to only a single precise critical element, it is clear the student will not have occasion to determine the relationships among several elements. It is consequently highly probable that the scenario does not measure at the analytic level.

Before correcting the exam, teachers come to an agreement on the answer keys. To improve reliability, correction is done in groups. This procedure can take one of two forms:

- In a summative correcting bee, correctors all work in a single room and each correct their own stack of examination papers, striving to work to the same rhythm so that they can discuss their understanding of their answers.
  - In home correcting, each person corrects certain questions on every test paper and then passes the whole to the next corrector. This method does increase the reliability of the correcting procedure, but it also increases the time lag between the exam and the giving of grades.
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## Tutor Assessments

There are many reasons to support the use of tutor assessment. This procedure enhances the value of tutorial learning -above all the acquisition of reasoning ability- as well as discussion, mutual help, and interaction among students. The quality of discussion that takes place here can be seen as a forerunner to the development of the physician-patient relationship. The goal is to highlight the expression of humanism the program is intended to foster; as well, it is felt that certain behaviors revealing of autonomous learning emerge here.

**The first version** of the tutor-assessment questionnaire, devised on the basis of samples supplied by other PBL programs, took four dimensions into account: Problem-based Learning (30% weighting), contribution to group effectiveness (30%), functioning as an autonomous learner (20%), and expression of the humanistic sense (20%). Each of these dimensions was expressed in six to eight examples of behavior.

This version was used during the first two years of implementation, that is, from 1987 to 1989. The grades assigned ranged from unsatisfactory to exceptional (from 3 to 10 points). A single comprehensive grade had to be given for each of the four dimensions. The intent was thereby to force discrimination among students' performances. If such discrimination did not take place, tutor assessment grades would turn into nothing more than a bonus for everybody and have no value.

**The second version.** Beginning in June 1988, the first assessment grid came under heavy fire from both students and tutors. It was criticized as describing behaviors too vaguely and permitting flagrant subjectivity. Some claimed that the assessment procedure distracted the tutor, who, it was said, should be free to facilitate learning. Teachers in basic science expressed reservations about passing judgement on student progress. During professional development workshops, tutors were asked to modify the examples of behaviors and suggest new ways of expressing humanism during the tutorial.

Parallel to this, a validity study was undertaken by R. Hébert and G. Bravo (Hébert & Bravo, 1989) of the Faculty. Using the critical incident technique devised by Flanagan, these researchers drew up a list of behaviors found among twenty students who had completed their first year and 79 PBL tutors. Tutors and students alike were asked to assess the usefulness of the items in the first version, specify which statements should be reformulated or simply rejected, and suggest other behavioral examples. The participation rate was 40%. The results of the study yielded a description of 48 new behaviors. For each item, the assessor is called on to determine whether the behavior occurs rarely, not at all, sometimes, quite often, or very often. Two groups of tutors acting as expert advisors went over the theoretical classification of items by domain in order to produce a new grid. This new grid was applied experimentally in four units at the same time as the first official

version. As a result, 271 assessments were analyzed, giving a response rate of 68%. Analyses of internal consistency and like-mindedness among correctors, as well as factor analyses, were conducted. Internal consistency was 0.87 using the adjusted Spearman-Brown index and 0.9 using the Alpha-Cronbach index.

Four factors alone explain 78% of the variance: effectiveness within the group (24 items), communication (8 items), interpersonal relations (7 items), and organization of time (4 items). This operation thus led to the elimination of items and the retention of 30 for a second stage of analysis. These were grouped around four factors and explain 92% of the variance: effectiveness within the group (9 items), contribution to group spirit (5), respect for colleagues (3), and optimal use of working time (3). Internal consistency remained at 0.92 (Alpha-Cronbach index) for these 30 items.

This validity study thus yielded a new list of 30 items whose internal consistency was high. The grid's precision was thereby greatly improved, seeing that effectiveness within the group and mastery of PBL techniques linked to reasoning abilities cannot be dissociated from each other. This link would seem to arise naturally, since mastery of PBL procedures is an essential condition for effective tutorial work and the problem analysis that leads to medical learning.

Despite certain divergences between the original structure of the assessment grid and the data yielded by the researchers' validation study, we can conclude that these analyses, especially the factor analysis, gave the grid a high degree of validity.

This dual process -the validity study and the devising of more specific behaviors in tutors' workshops during 1988-89- allowed for the development of a second version of the assessment grid. This version contained 62 behaviors, grouped in three subsections: reasoning ability, expressed in 29 behaviors (weighting of 50%); communication and interaction (effectiveness within the group and contribution to group spirit), expressed in 13 behaviors (30%); autonomy and humanism (respect for colleagues), expressed in 20 behaviors (20%). It was this version that was used during the third year of implementation. The strategic objective of the new grid was to offer tutors a wide range of behaviors, enabling them to integrate the dimensions requiring assessment.

**The third version.** During professional development workshops held in 1989-90, the 62-behavior grid was reviewed by 116 tutors. They were asked to score each item on a usefulness scale from 1 (not very useful) to 3 (very useful). This exercise yielded a third version (Appendix 1) used from 1990 to 1991. It contained only 44 behaviors, grouped around these three dimensions: problem analysis (equivalent to reasoning ability in the previous grid), which was expressed in 20 behaviors (weighting of 50%); communication and interaction, expressed in 12 behaviors (30%); and humanism and autonomy, expressed in 12 behaviors (20%).

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The changes in weighting resulted from studies that had been carried out and from experience acquired during tutorials. As the PBL system matured, it became evident that the teaching staff wished to see problem analysis given more prominence. It appeared, further, that only behaviors that were most likely to manifest themselves during tutorials should be weighted. That is how humanism and autonomy, grouped together, came to have their weighting markedly reduced. It proved to be more difficult than foreseen to measure their expression.

These transformations led to most tutors' acceptance and careful filling out of the assessment grid used to assess students. The distribution of grades (Table VII) testifies to this concern.

Table VII. Variation in tutors' grades by unit, expressed as a percentage of all grades for phase II, 1990-1991

PERFORMANCE SCALE/MASTERY OF OBJECTIVES								
	unsatisfactory		Borderline		Competent	Highly competent		Superior
	3	4	5	6	7	8	9	10
1st year			1%	1%	38%	42%	14%	4%
2nd year				3%	39%	39%	17%	2%

### Assessment for the Multidisciplinary Problem-Integration Unit

For the multidisciplinary unit of phase III (unit 14), held in the first trimester of the third year, both the PBL method and assessment change. Here, the written examination still includes multiple-choice questions and open short-answer questions, but implementation of the problem-solving method requires reflection on what assessment type corresponds to this new type of learning. The person responsible for the unit devised a new structured oral exam inspired by the triple jump technique (Painvin et al., 1979). Groups of 16 students were convened in a room in successive waves, each group being presented with three short clinical problems. For 45 minutes, each student analyzed the cases and worked out possible solutions, using their own notes. Then each student went before an examiner and discussed the three cases over a 30-minute period.

The examiner graded the students' performance by assigning a percentage using a pre-established answer grid. If the student brought out the required aspects of the case, he or she was given a "pass" grade, or 60%. For the final result, graded from 60% to 100%, the examiner assessed the overall quality of discussion (clarity, logic, completeness, systematic nature) using the following grid: 60-75%: the student offered adequate discussion but required contributions by the examiner; 75-80%: the student offered a very good discussion which required only minimal contribution by the examiner; 85% and over: an excellent spontaneous discussion, requiring no contribution by the examiner. Students nearly unanimously stated that this structured oral examination genuinely measured their analytical and problem-solving abilities.

During the multidisciplinary unit, the tutor becomes a mentor. Learning assessment then relates to the process of problem analysis and problem solving (entailing a new component that represents 40% of the overall grade assigned by the mentor), contents in relation to the examination of the current problem (40%), and the student's ability to present and prepare the problem analysis (20%).

## Peer Assessment

At this stage, the program brought in a further new component, namely peer assessment occurring within the small group of students. Each student's seven peers assess his or her intellectual qualities, i.e., ability to use the analytical procedure (40%) rather than relying exclusively on knowledge. The assessment also bears on the quality of the student's interpersonal relations (60%). Although the assessment is summative, representing 5% of the total trimester grade, it features a formative dimension, because every student must identify in every other student three behaviors they particularly appreciate and three weaknesses that are subject to correction.

From the first year this new type of assessment was implemented (fall of 1989), it was necessary to dedicate a three-hour workshop to preparing students for it, so that they would not get drawn into an exercise in mutual assured destruction. Formative comments are communicated anonymously to each student and are not consigned to his or her academic file. So far, the experience has proven highly successful, with students now showing great concern for integrity and respect (Paquet and Des Marchais, 1996). The preparatory workshop is offered every year.

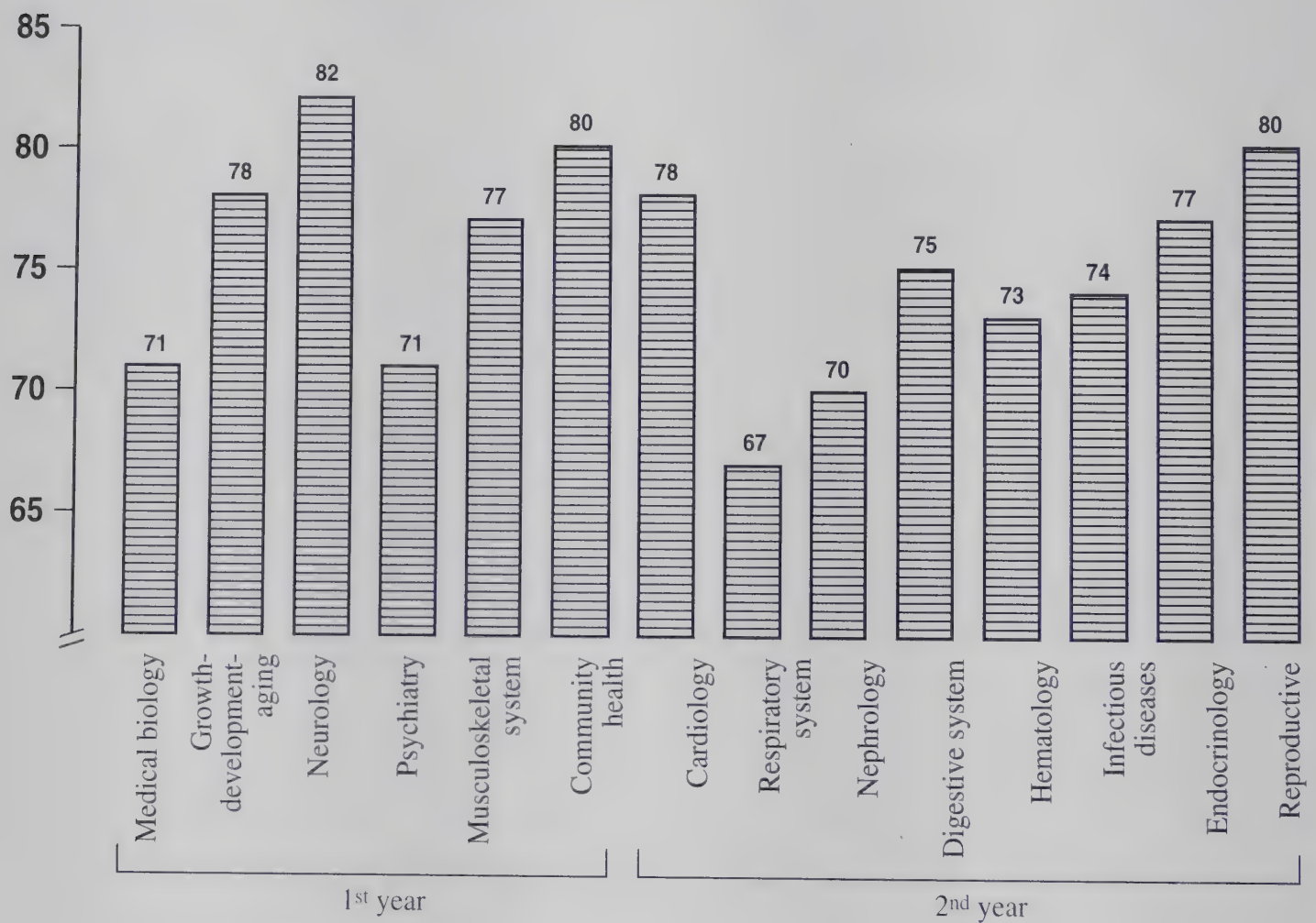
At the end of the first trimester of the third year, the assessment system features a promotional examination that determines entry into clerkship. A student's entry is sometimes postponed, if tutors and mentors consider that she or he has not yet displayed adequate behaviors and interpersonal skills for clinical education.

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## Assesment Results

It may be of interest to view the general profile of student performances by unit, by compiling results from the three methods of assessment for the three first-year cohorts and the two second-year cohorts for the period 1987-90 (Table VIII).

Table VIII. Variations in mean performance of students by unit phase II\*



\* Average of all assessment methods

We note that, in first year, the medical biology and musculoskeletal system units appear to be the most difficult, with overall grades averaging 71%, whereas the nervous system and community health units appear easier. Students themselves were aware that the exams in medical biology and the musculoskeletal system were the hardest. In second year, the respiratory system and urinary system (nephrology) units are the hardest, whereas the reproductive system (gynecology), cardiovascular system (cardiology), and endocrine system (endocrinology) units seemed the easiest. Overall, it may be observed that second year is a little harder (74%) than first year (76%).

The assessment methods designed and integrated into the preclinical program would appear to be necessarily "traditional". Even though we wished to design a student centered program, our assessments may have remained too "conventional". Nevertheless, they allowed us to confirm that, despite the fact that we were now using very different teaching methods, students were succeeding in mastering a common knowledge base. Yet we must ask whether we were measuring that which really ought to be assessed. This was the question we now felt we had to confront.

## Analysis of the Assessment System

We undertook a series of studies to better determine how the different assessment methods just described measured the various learning domains during PBL. These studies were designed to assess the validity and reliability of the methods and determine how examination results could be effectively used to assess and promote students. In other words, we wished to gauge the test-measurement, or docimological, validity of our instruments. The results of these studies led to our entertaining the possible usefulness of a multidimensional approach in assessing student performance (Des Marchais and Nu Viet Vu).

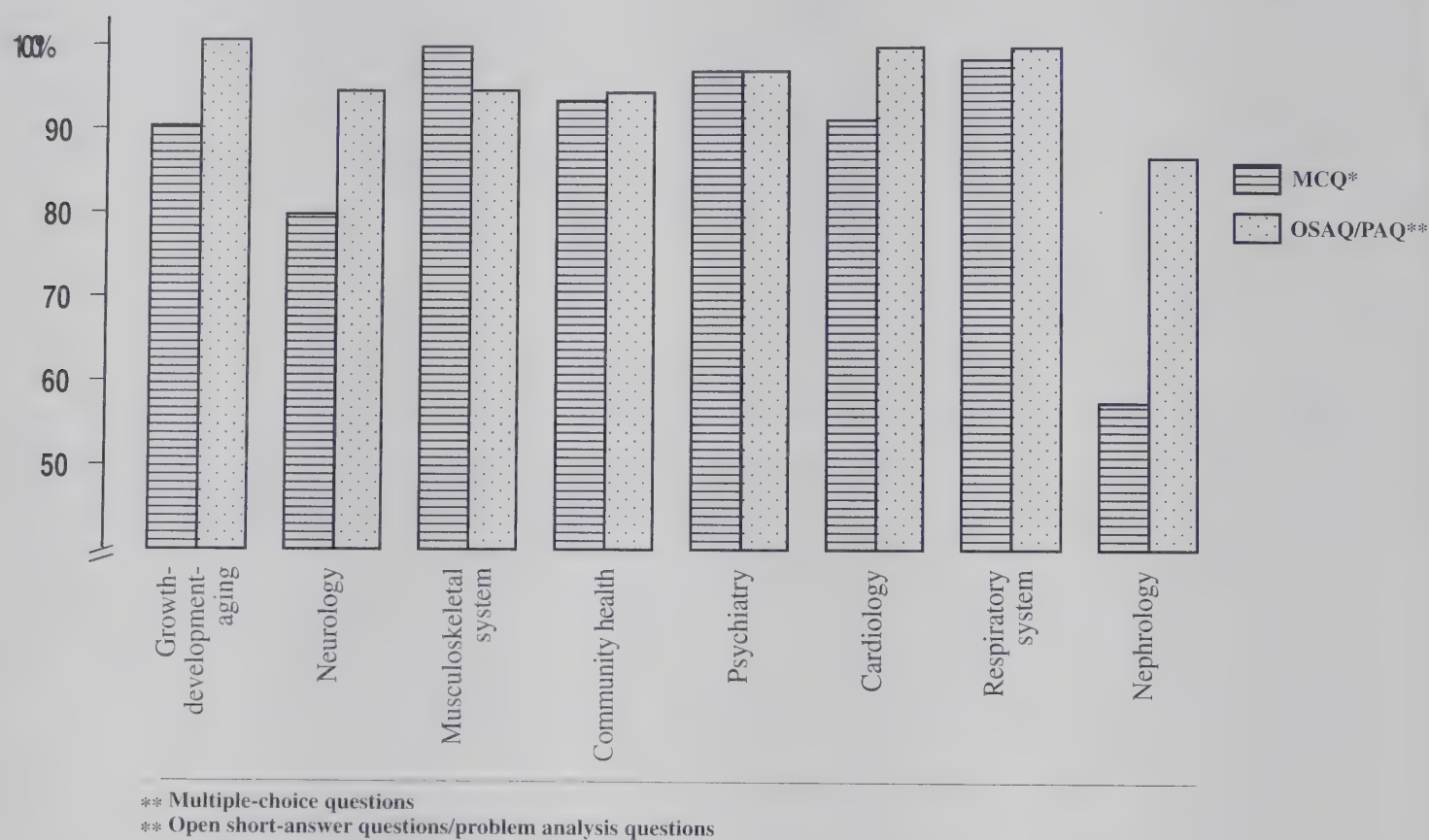
## Content Validity

Given that summative written examinations aim to assess the level of knowledge the students acquire in the units, it is necessary to determine as precisely as possible whether exams measure the mastery of these units' contents effectively. The validity study of the summative written examinations of the program's first two years was thus intended to determine to what extent these examinations' contents covered the objectives of both the units and the problems used in tutorials. For this study (Table IX), exams from eight out of thirteen units (61%) in phases I and II for the class of 1988-92 were reviewed by one of the tutors for each unit. Tutors revised each examination question and determined whether it was tied in with one or more unit objectives or unit-problem objectives. The results showed that an average of 97% of the questions in each unit was explicitly linked to unit or unit-problem objectives.

This consistency between objectives and examination questions is greater for OSAQs and PAQs than for MCQs, especially in the case of the urinary system unit, where the MCQs measure only 60% of problem objectives.

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Table IX. Percentage of written questions that explicitly covered PBL problem objectives for 8 out of 13 phase II units, according to 8 tutors



In order to better validate these results, every student in the class of 1988-92 and that of 1989-93 was asked, at each summative examination, to evaluate whether the examination questions covered unit objectives, using a scale of 1 (very little = less than 60%) to 5 (fully = over 90%). Five of the six first-year units received an average evaluation of 3.3 to 4.1, whereas six of the eight second-year units were given a score of 2.9 to 3.5 (Table X).

In general, students and teachers indicated that the content of most of the exams covered unit or unit-problem objectives. It is noteworthy that the three units (musculoskeletal system, respiratory system, and nephrology) that received a relatively low average evaluation, i.e. one that fell between 2.5 and 2.7 (2 = 60% of objectives), are also those that students considered to be the most difficult. Student performances were generally lower in these units than in others.

### Construct Validity

Attaining consistency between the intentions of the reform and the assessment methods that were put forward required that, beyond measuring the acquisition of knowledge by means of MCQs, measurement be done of students' ability to interpret and apply

knowledge and analyze and solve problems. It was to meet this need that we devised the OSAQs and PAQs. To verify whether these questions truly measured at the taxonomic level that they were supposed to, we undertook two further studies.

Table X. Student evaluations\* of questions on written examinations according to fit\*\* with objectives to be convered in each unit

UNIT	MCQs	OSAQs	PAQs	Average /unit
First year				
Medical biology	4.2	4.1	4.1	4.1
Growth-development-aging	3.4	3.6	3.4	3.5
Neurology	3.1	3.3	3.5	3.3
Musculoskeletal system	2.7	2.8	2.7	2.7
Community health	3.5	3.7	3.6	3.5
Psychiatry	4.4	4.1	2.8	3.7
Second year				
Cardiology	3.3	3.5	3.3	3.3
Respiratory system	2.5	2.6	2.7	2.5
Nephrology	2.4	2.8	2.6	2.6
Digestive system	2.9	3.2	3.3	3.1
Infectious diseases	3.3	3.2	3.1	3.1
Hematology	2.8	3.0	3.0	2.9
Endocrinology	3.0	3.3	3.3	3.2
Reproductive system	3.4	3.4	3.5	3.4

\* For the classes of 1988S92 and 1989S93.

\*\* Level of fit, going from low (1) to high (5).

In the first study, eight students in the 1987-91 cohort were asked to classify twenty second-year OSAQs and twenty second-year PAQs, while seven 1988-92 students did the same for twenty first-year OSAQs and twenty first-year PAQs. Participants were chosen from among the strongest students. For each question, each student determined individually whether this was strictly a memorization question, a memorization question involving interpretation, or a memorization question involving interpretation and analysis. The results (Table XI) show that 40% of OSAQs were classified by the first cohort and 50% by the second as measuring both interpretation and application of knowledge, while, according to the first cohort, 45 PAQs measured problem analysis and; according to the second cohort, only 30% did so.

Table XI. Classification by students of cognitive levels addressed by OSAOs and PAQs

QUESTION	CLASS OF	COGNITIVE LEVEL			
		MEMORY	INTERPRETATION	ANALYSIS	UNCLASSIFIED
OSAQ*	1987-1991	35%	40%	5%	20%
	1988-1992	35%	50%	10%	5%
PAQ**	1987-1991	20%	30%	45%	5%
	1988-1992	25%	15%	30%	30%

\* Open short-answer question

\*\* Problem analysis question

A second, similar study was undertaken, but strictly on PAQs, in order to confirm these results. Eight students and nine teachers reviewed and classified 76 PAQs from three first-year units, while eight students and seven teachers did the same for 72 PAQs from three second-year units. Once again, participating students were chosen from among the strongest and teachers were chosen from among those known to be competent in medical education. Students and teachers used Angoff’s technique (Angoff, 1971) to classify the questions. Participants in each group first judged a question’s cognitive level as individuals. After each participant had shared his or her classification with the others, the group discussed it and determined on a new classification, if appropriate, by consensus.

The results of this study (Table XII) show that both teachers and students considered only one-quarter (25 to 28%) and one-third (32 to 35%) of PAQs to measure at the taxonomic level of problem analysis.

Table XII: Classification of PAQ cognitive levels

			COGNITIVE LEVEL		
PARTICIPANTS	NUMBER	YEAR	MEMORY	INTERPRETATION	ANALYSIS
Students Teachers	8	1st	26%	42%	32%
	9	1st	21%	51%	28%
Students Teachers	8	2nd	18%	57%	25%
	7	2nd	29%	36%	35%

These results suggest that questions measuring problem analysis are harder to construct than questions measuring application of knowledge. As well, students' and teachers' comments led us to believe that determination of the cognitive level addressed by questions varies according to the student's or teacher's level of knowledge. The study of the coefficient of agreement (the K coefficient) shows that there is little agreement between students' classifications and teachers' (0.04 to 0.46). In other words, students and teachers are not in agreement as to what constitutes a good PAQ (Des Marchais et al., 1997).

Nevertheless, since we persist in believing that classification by students represents a more valid index for evaluating a PAQ's cognitive level, we asked all students to classify PAQs at the moment of writing their exams for two consecutive years. The results of this third study, which related to 431 PAQs in 1990-91 and 403 in 1991-92, and in which 196 students participated in 1990-91 and 202 in 1991-92, are presented in Tables XIII and XIV.

The message comes through loud and clear. Even though teachers think they are producing good PAQs, only 34% of first-year students and 14% or 17% of second-year students consider them as such. It is harder than we thought to measure problem-analysis ability.

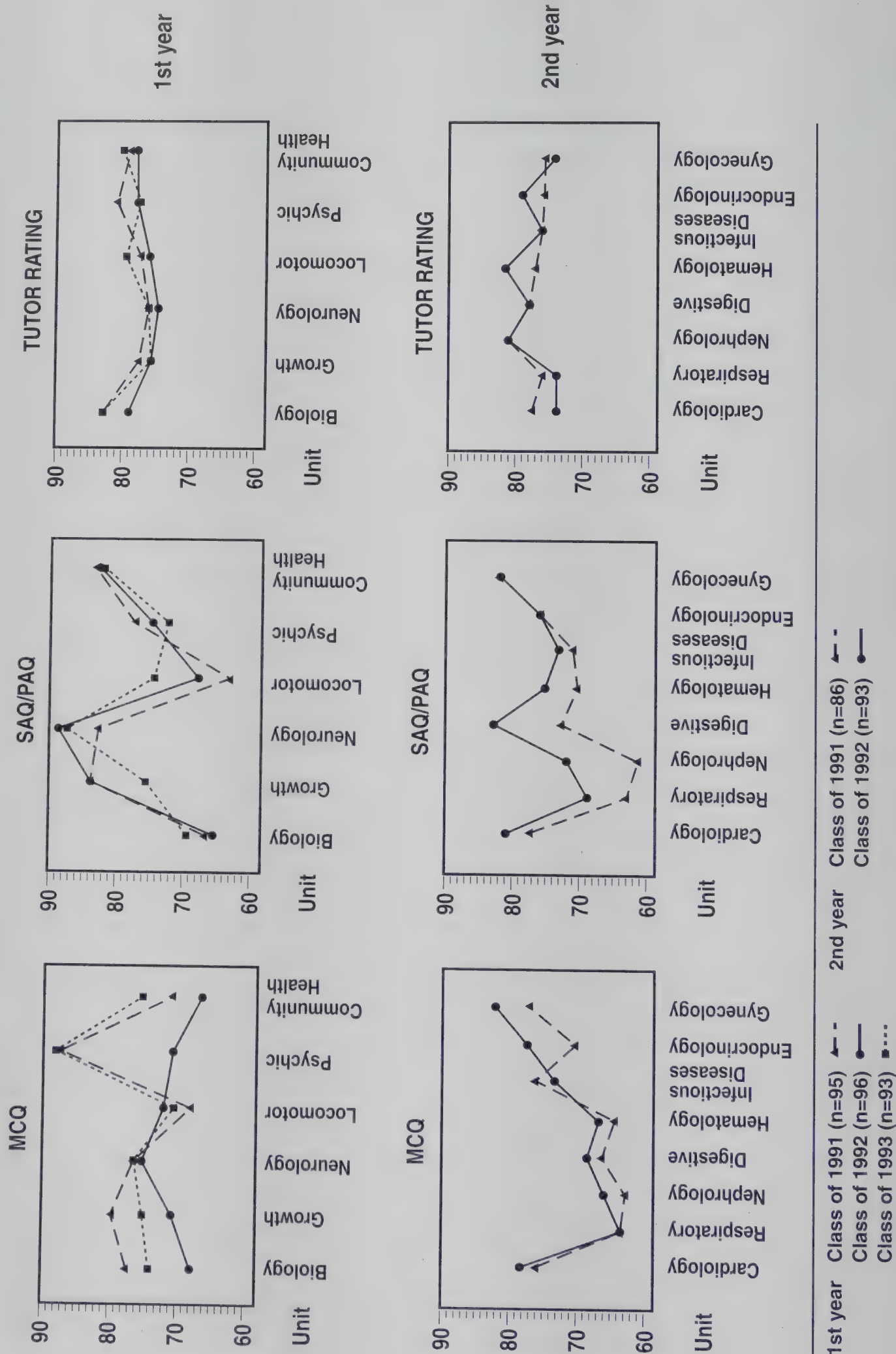
Table XIII. Classification by students in 1990-1991 of taxonomic level addressed by problem-analysis questions

	COGNITIVE LEVEL		
	MEMORY	INTERPRETATION	ANALYSIS
1st year	30%	36%	34%
2nd year	25%	61%	14%

Table XIV. Classification by students in 1991-1992 of taxonomic levels addressed by problem-analysis questions

	COGNITIVE LEVEL		
	MEMORY	INTERPRETATION	ANALYSIS
1st year	34%	32%	34%
2nd year	22%	61%	17%

Table XV. Table XV. Student performance averages by kind of assessment and by year



## Reliability

At this stage, we needed to know the tests' degree of reliability. This is an essential component of validity. Unadjusted reliability indices for MCQs, OSAQs, and PAQs were calculated using the Kuder-Richardson 20 (KR-20) coefficient; adjusted indices were calculated using the Spearman-Brown coefficient.

In general, unadjusted reliability indices for MCQs varied from 0.25 to 0.80, and adjusted indices from 0.53 to 0.86. For OSAQs and PAQs, unadjusted indices of variability varied from 0.0 to 0.87; adjusted indices, from 0.0 to 0.83.

Overall, the level of reliability of questions, especially OSAQ and PAQ-type questions, falls in the lower and acceptable levels. This result may be attributed to correcting differences from one teacher to another. Taking this result into account, it seemed obvious that for future examinations, it would be necessary to increase the number of questions and establish better standardization in correcting OSAQs and PAQs. As well, in analyzing objective structured clinical examinations (OSCEs), we obtained these degrees of reliability, using the Alpha-Cronbach coefficient, for five examinations: 0.07 (16 stations), 0.25 (8 stations), 0.40 (13 stations), 0.64 (14 stations), and 0.66 (15 stations). Once again, the results suggested that the reliability of OSCEs would improve with an increased number of stations for each exam and more advanced standardization of instruments of assessment.

## Students' Comparative Performance: Written Examinations, Tutor's Grades, and OSCEs

In order to better assess each of the examination methods used according to their student-learning assessment objective, we analyzed and compared results obtained by the classes of 1987-91, 1988-92, and 1989-93 in written examinations, OSCEs, and tutors' grades.

In comparing the class averages obtained (percentage of grades) for MCQs, OSAQs, PAQs, and tutors' grades during first- and second-year units, it can be observed that written-examination class averages vary much more from one unit to another than the averages obtained from tutors' assessments (Table XV). Moreover, the curve in variation of averages for MCQs, OSAQs, and PAQs from one unit to another is similar for all three classes. These results indicate that student-learning assessment varies with each unit, and that this variability between units is relatively stable across years or classes. From these results it was inferred that in obtaining a comprehensive and valid student assessment, measuring a student's performance profile across all units is more exact.

To better assess the variation observed in student performances from one unit to another, all that remained was to carry out a correlation study in different units. Correlations were

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calculated for the first and second years of the class of 1987-91. For MCQs, the spread of correlations was from 0.21 to 0.56 in first year and 0.22 to 0.42 in second. For OSAQs and PAQs, correlations ranged from 0.22 to 0.56 in first year and 0.35 to 0.62 in second. When it came to tutors' grades, correlations varied from 0.0 to 0.45 in first year and 0.0 to 0.56 in second. Correlations obtained for the class of 1988-92 were similar to those of the class of 1987-91. The averages of tutors' grades did not vary much from one unit to the next; it was the grades obtained by students on the basis of tutor assessments that varied. These results suggest yet again that assessment of students' performance during tutorials has greater validity if their performance across units is taken into consideration. To better determine students' level of learning, it is necessary simply to determine the level of correlation between their performance on MCQs, OSAQs, and PAQs and tutors' grades (Table XVI).

Table XVI. Variation in student-performance correlations for units in the first two years

	1st year	2nd year
MCQs/OSAs + PAQs	0.44 S 0.82	0.37 S 0.53
MCQs/TUTOR ASSESSMENTS	0.0 S 0.56	0.0 S 0.47
OSAs + PAQs/TUTOR ASSESSMENTS	0.0 S 0.60	0.0 S 0.45

Correlation of MCQs with OSAQs and PAQs varied from 0.44 to 0.82 for the first year and 0.37 to 0.53 for the second. Correlations between MCQs and tutors' grades varied between 0.0 and 0.56 for the first year and 0.0 and 0.45 for the second. Correlations between OSAQs and PAQs and tutors' grades varied between 0.0 and 0.60 for the first year and 0.0 and 0.45 for the second. Since examination methods are devised to measure different kinds of performances, these correlations would suggest that MCQs/OSAs + PAQs are more likely to classify students the same way than do tutor assessments. To obtain a more valid assessment of the student, then, his or her performance profile must be compiled for each examination method across all units.

These results led us to another conclusion: more exact results are achieved in measuring students' performance if they are assessed in relation to their performance on MCQs, OSAQs, and PAQs, but also by using tutor assessments. Further, the studies we conducted on the construct validity of OSAQs and PAQs would lead one to believe that even though these categories of questions tend to classify students the same way, they measure differing cognitive levels.

## Comprehensive Grading

These correlation studies taken together led to the conclusion that different assessment formulas, including tutor assessment, can contribute to students' performance assessment. However, the assessment of student performance is enhanced by an approach that is multidimensional (combining different forms of assessment) and longitudinal (looking at results across units). An approach of this kind yields grades in the form of subtotals both for the material in different units and for the tutors' three assessment domains. At the end of each year, the Promotion Committee reaches a judgement by taking into account the pass level determined for each unit.

Table XVII presents an example of a grade matrix that such a system supplies. From this point on, the Committee was required to formulate its decisions based on the contents of this matrix. What remained to be fixed, however, was the yearly comprehensive passing grade determined on by tutors. In the case of failure, what learning requirements would be set for the student in order to pass? In the example provided in Table XVII, the year grade for communication is low as a result of a poor assessment for the respiratory system unit. This case would be brought to committee if the passing grade was 70%. The same goes for the analysis dimension. Although having attained a general average of 73%, resulting in large part from the written examinations, this candidate will doubtless require the help of a student advisor in the learning process. Tutor assessments thus acquire a larger contributory role when a multidimensional approach is taken.

## Discussion

It can be observed that students attain average results for MCQs that are quite similar to those of cohorts in the old program. Since a large proportion of the MCQs used come from the same bank, we can conclude that the teaching staff fears that PBL would not allow for mastery of as much knowledge as traditional teaching were unfounded. Both teachers and students consider MCQs to relate to the material covered by the problems addressed. These problems were developed, to all intents and purposes, on the basis of the old course contents. For these reasons, it should be recognized that the contents of the program were not significantly altered by the introduction of PBL, at any rate, not as regards the portion considered essential by teachers.

The devising of new written questions, in particular OSAQs and PAQs, allows us to measure higher cognitive levels than memorization. The construct validity analysis of OSAQs and PAQs shows that 70% of the questions measure levels higher than that of memorization. Students consider that in general these types of questions do relate to the material that needs to be covered. Nevertheless, there is no agreement between teachers and students as to which PAQs better measure analytical ability.

Table XVII. Example of a second-year student's results profile, in percentages  
For written examinations, clinical skills, and tutor assessments

	Cardiovascular system	Respiratory system	Urinary system	Digestive system	Blood and immune system	Infectious diseases	Endocrine system	Reproductive system	Student average	Class average (standard deviation)
<b>Written Examination</b>										
MCQs*	53	59	60	62	50	77	64	35	58	75(10)
OSAQs*	76	50	79	71	58	81	65	59	67	76(9)
PAQs*	79	55	71	87	67	63	74	40	67	76(12)
<b>Student average</b>	<b>72</b>	<b>56</b>	<b>70</b>	<b>72</b>	<b>59</b>	<b>75</b>	<b>68</b>	<b>47</b>	<b>65</b>	<b>78(6)</b>
<b>Class average (standard deviation)</b>	<b>83(10)</b>	<b>75(9)</b>	<b>72(11)</b>	<b>77(9)</b>	<b>78(13)</b>	<b>82(9)</b>	<b>78(9)</b>	<b>82(14)</b>		
<b>Tutor assessments</b>										
<b>Student average</b>	<b>87</b>	<b>77</b>	<b>75</b>	<b>70</b>	<b>80</b>	<b>70</b>	<b>80</b>	<b>80</b>	<b>77</b>	
<b>Class average (standard deviation)</b>	<b>81(9)</b>	<b>82(7)</b>	<b>85(7)</b>	<b>80(8)</b>	<b>80(7)</b>	<b>77(7)</b>	<b>85(8)</b>	<b>75(7)</b>		<b>81(7)</b>
<b>Clinical Skills</b>										
- written examination									<b>85</b>	<b>81(7)</b>
- OSCE									<b>95</b>	<b>90(6)</b>

\* MCQ: multiple choice question OSAQ: open short-answer question PAQ: problem-analysis question

Summative assessment was reduced to three periods per year. These periods always give rise to increased stress among students. Some teachers have, on several occasions, proposed a return to the system of setting one exam after each unit. For the time being, those leading the reform in teaching and learning have no reason to believe that this would constitute an improvement in the education/assessment system. On the contrary, a reduction in the occurrence of examination periods has been considered preferable in order to leave students greater freedom to learn and allow them to better integrate material from different units. We believe that the period of preparation for examinations also contributes to the realization of these educational goals.

Student assessment by tutors constitutes the Achilles heel of the new assessment system. We persist in believing that it is necessary, via PBL tutorials, to continue highlighting analytical procedures, as well as students' skills in interaction and the development of autonomy and humanism. If it is true that we believe in these values, and if we genuinely wish students to be initiated into them and eventually master them, it is incumbent upon us to include them in the process of education and in summative assessments, while giving them an appropriate weight. Let us be frank: it is our wish that ten years down the road from graduation, when students have forgotten a large number of facts, they remain humane physicians who are effective in relationships with patients, capable of maintaining their competencies, and concerned to handle clinical problems in a scientific fashion. These students will be the "products" of an educational process that stresses an analytical approach and mastery of scientific reasoning. These qualities and attitudes are not acquired through one intensive course. To master them it is necessary to go through a series of learning and assessment activities that fall on a continuum along which certain educational objectives are constantly reinforced. Tutor assessment is justified by the need to highlight continuous learning. Not just the PBL units, but also the longitudinal unit on clinical skills and the reform of the clerkship, each in its way, contributes to achieving these educational goals. It is for this reason that we intend to maintain a weighting for these dimensions in our assessment system through the whole of preclinical training: after all, they become indispensable components of clinical competency.

Moreover, experience has shown that tutor assessment is not of the same kind as the measurement of factual and analytical learning which takes place through written examinations. Tutors seem to provide earlier screening of weak students, those with communications difficulties or interpersonal problems, those who are not self-sufficient, those who get carried along by the group, and those whose analytical contributions always echo what is said by others. This early screening, when confirmed by grades given by tutors in several units, takes on major significance if we wish to offer the weaker students appropriate compensatory activities.

Besides, the assessment potential of tutors is not yet being fully used. According to one study, only two factors influence the distribution of tutors' grades. Units lasting longer than

four weeks promote a wider grade distribution. The same is true when the overall average of tutors' notes is high. It should thus be possible to better identify weaker students.

The above series of analyses of assessments has led us to propose promotion criteria broader than those of subject promotion. The dimensions of analysis (accounting for 50% of the grade), communication, humanism, and autonomy, assessed by tutors, should become a longitudinal summative component, converted into a final grade at the end of the year (although measured for each unit). This approach would no longer allow students the possibility to redeem a low grade related to knowledge with a high tutor assessment. At the same time, the dimensions tutor assessment as designed to measure would not be lost. It would be possible for promotion-related decisions to require a student to take a single unit over. Moreover, recourse could be had to the exceptions to the University's *Règlement des études* from which the Faculty of Medicine benefits, so that the Promotion Committee might recommend compensatory measures (taken during the summer vacation, for example) to students whose performance on tutor-assessed dimensions is very poor. This approach has begun to be applied pending discussion by the Committee, because passing levels need to be determined for tutors' use. An assessment model of this kind, which would be consistent with the PBL construct and goals, entails increased tutor education. They must be turned into better assessors and be given more sensitive and reliable instruments for measurement.

## Conclusion

A study of the question of student-learning assessment shows that, in the matter of assessment, the goals of the reform have all been implemented except where formative assessment is concerned: here, action taken has been hesitant. The idea of devising PAQs led to an improvement in written examinations' taxonomic levels, with 70% of questions now measuring more than memorization alone. As well, MCQs were retained because they are valid, reliable, and highly practical in measuring knowledge of basic medical facts whose acquisition is necessary to any clinical procedure. Tutors' assessment grid has been progressively improved in form, and the process of using it is now accepted by most teachers. On the other hand, tutors do not necessarily all share the same assessment of a competent student's behavior. For this reason, it is difficult to standardize the criteria they use in judging it. We may have thought our system was fine-tuned. Far from it: a whole new series of questions are looming on the horizon.

The implementation of the preclinical program and the assessment system that goes with it shows once again how assessment methods tend to steer students' in their learning. Many students have been invoking the specter of diseases of the curriculum once again.

Written examinations have led to a highly structured educational system, perhaps too structured, since students know very well that examination questions will be developed

exclusively out of tutorial problems. Consequently, many students claim that written examinations, including PAQs, do not really direct students towards mastering knowledge of the various systems, at least not before third year. Thus the educational system is reverting to being closed, rigid, and limited, which is in direct contradiction to the philosophy of the PBL method. Why not, then, replace PAQs with structured oral examinations like those of the multidisciplinary unit in third year?

Although summative evaluation periods have been reduced to three in number per year, each such period provokes marked stress over several weeks among the majority of students. And yet, looked at comprehensively for the four years of the program, our failure rate is lower than 3%. Some would have student-performance assessments take place only once per year, in order to leave students the freedom to learn. Others suggest tutors should not be involved in assessment. Yet, assessment is an inseparable component of the responsibilities of any teacher of a course, even in medicine. It is also a social responsibility of educators to guarantee the quality of the education received by graduates (Des Marchais & Nu Viet Vu, 1996).

Following six years' experience, armed with the results of our reform, we are in a position to review our assessment system and make of it a better stimulus to learning, above all, to the integration of knowledge. We are all relatively satisfied with the dimensions for assessment and the weightings chosen by the tutors, but our written examinations no longer deal with a simple sampling of the material. They come close to measuring all of it. Teachers, wishing to ensure that students learn medicine, feel the need to check whether almost all the material has been covered. Perhaps we should let go of this compulsion, without forgetting our obligation as assessors to see to it that students learn the science and art of medicine better and for a longer time.

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APPENDIX I

Summative Assessment by Tutor During Problem-Based Learning Tutorials

I) ANALYTICAL PROCEDURE (50%)

- Identifies and clarifies components of the problem.
- Approaches the problem in a systematic and organized fashion.
- Formulates the problem in a single line.
- Acts in a manner appropriate to the phase of the problem under way.
- Establishes a link to relevant readings, experiences, or knowledge (from clerkship or prior studies).
- Identifies significant indices, sorts them, and records their priority.
- Organizes information available.
- Puts forward explanatory hypotheses.
- Tests or critiques these hypotheses.
- Advances a synthesis or puts forward a schema that brings together several hypotheses.
- Skillfully separates the essential from the secondary.
- Grasps the elements that are critical to diagramming the problem.
- Participates actively in developing learning objectives.
- Identifies well-defined and specific questions for study.
- Determines the priority of subjects for study.
- Rather than reading off references, applies new knowledge to problem analysis.
- Brings own findings to bear during synthesis.
- Engages in self-questioning and seeks to go further through group questions.
- During synthesis, presents material in a structured way.
- Demonstrates critical sense with respect to other students' presentations.

<input type="checkbox"/> Unsatisfactory	<input type="checkbox"/> Borderline	<input type="checkbox"/> Competent
<input type="checkbox"/> Very competent	<input type="checkbox"/> Superior	

II) COMMUNICATION-INTERACTION (30%)

- Shares information.
- Puts questions in order to deepen understanding of obscure points or facilitate comprehension and discussion.
- Brings the group back to the stage in progress.
- Summarizes what HAS been said, takes bearings.
- Brings about a breakthrough when the group is going around in circles or stagnating.
- Offers constructive criticisms to the group and to colleagues.
- Shows tact in evincing disagreement with a student's or tutor's domination of discussion (does not withdraw, fall silent, or become apathetic).

- Sensitizes the group to passage of time (suggests or ensures enforcement of reasonable limits).
- Does not interrupt others unduly.
- Does not monopolize the floor.
- Contributes to a climate of harmony within the group.
- Participates actively in group's self-assessment.

☐ Unsatisfactory      ☐ Borderline      ☐ Competent  
☐ Very competent      ☐ Superior

### III) HUMANISM AND AUTONOMY (20%)

- Respects values and opinions of peers.
- Broaches different complementary aspects of a problem (legal, ethical, humanistic ...) in an appropriate way.
- Communicates with others without hostility.
- Draws attention to another person's error in a respectful manner.
- Can acknowledge own errors.
- Respects others' turn to speak.
- Demonstrates responsibility for his or her own program of study.
- Is capable of making use of resources.
- Can evaluate effectiveness of his or her own plan of study.
- Clearly identifies own weaknesses and strengths.
- Shows that she or he is up to date in work.

☐ Unsatisfactory      ☐ Borderline      ☐ Competent  
☐ Very competent      ☐ Superior

#### DESCRIPTION OF LEVELS OF ASSESSMENT

<b>UNSATISFACTORY:</b>	Unacceptable performance.
<b>BORDERLINE:</b>	Performance below expectation, failure to achieve objectives. A sign that specific elements must be improved.
<b>COMPETENT:</b>	Performance in line with expectation and mastery of objectives.
<b>VERY COMPETENT:</b>	Performance that exceeds general expectations and goes beyond the objectives.
<b>SUPERIOR:</b>	Performance that exceeds all expectations for student behavior and attainment of objectives.

APPENDIX II

Examples of PAQs

MEDICAL BIOLOGY II (1990-1991)

Here is a serology result. What infection is indicated? Justify your answer.

	<u>1st serum</u>	<u>2nd serum</u>
Influenza A	1/8	1/8
Influenza B	0	0
Parainfluenza type 1	0	0
Parainfluenza type 2	0	0
Parainfluenza type 3	0	0
Mycoplasma pneumoniae	1/2	1/2
Respiratory syncytial virus	0	0
Adenovirus	1/2	1/32
Legioniella pneumophila	0	0

MEDICAL BIOLOGY II (1991-1992)

A series of compounds (A to F) were studied in an in vitro test. The results obtained are presented on the following graph:

- A. Classify the compounds A to F by agonists, partial antagonists, antagonists, or other.
- B. Estimate the EC<sub>50</sub> or apparent affinity and partial agonists.
- C. Classify the compounds in decreasing order of effectiveness.
- D. Specify the minimum and maximum number of different kinds of receptors that we would need to explain these results, on the assumption that the action of the agonists is the result of a direct effect at the tissue level.

GROWTH, DEVELOPMENT, AGING (1990-1991)

Lucy, a member of the Lafrance family, is an albino. You have drawn the following family tree, based on the family history you have gathered.

1. What kind of heredity is in question here?
2. If IV-4 married someone who was heterozygote for this anomaly, what are the chances of their child being an albino?

NERVOUS SYSTEM (1990-1991)

Ms. Rosenzweig, aged 49, is brought to the hospital by her husband because she has difficulty walking and is experiencing mental disorders. She cannot provide a reliable history. Her husband explains that three years ago she began complaining of pins and needles in her feet and hands, and then in her knees and elbows. Over the past 18 months, her gait has become less and less coordinated, and she has developed weakness in the legs and mental problems. At the start she was irritable and complained of poor memory; now she believes her husband is trying to poison her. Her memory has deteriorated greatly; at night she is disoriented. She wets herself when she urinates and does not try to wipe herself.

Upon being examined, she shows signs of dementia and ataxia. Her integument is pale; she has a pulse of 98. Although she can stand up unaided, she comes close to falling down if she closes her eyes. Her legs are weak, especially in the flexors. Her tendon reflex is reduced in the arms and completely absent from the legs. Babinski signs are present. Her position sense is mildly reduced in her fingers and her feet. Her sense of vibration is missing at the iliac crest. Touch and sensitivity to pricking and temperature, including in the perianal region, are normal. The anal reflex and muscle tone are normal.

Circle the appropriate letters, taking into account the neurological table as a whole:

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
ST	D	M	V
FP	G	N	D
S	M	I	I
P	DIFF.		N
M			A Specify: ____

PSYCHOLOGICAL SCIENCES (1990-1991)

Mr. Boswell, aged 50, lost his wife two years ago (she died of breast cancer); furthermore, he has lost his job and his only child is having investigations done further to an HIV-positive result. He presents with severe depressive symptomatology, including significant psychomotor retardation.

You recommend treatment with antidepressants. The patient is opposed, claiming that his depression is a "reaction" to his misfortunes, that "pills" will not solve his problems, and that in any case nothing can be done for him.

What is your interpretation of Mr. Boswell's remarks?

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**CARDIOLOGY (1990-1991)**

You have taken simultaneous blood specimens from the coronary sinus and the aorta from an angina patient, first during rest and second during exertion sustained until the appearance of anginal pain.

You measure the lactic acid in each of the two specimens.

- A. Which of the two coronary sinus or aorta specimens shows a higher level of lactic acid?
- B. Explain why.

**RESPIRATORY SYSTEM (1991-1992)**

A 40-year-old patient who smokes 30 cigarettes a day and is known to have chronic bronchitis presents at emergency for significant gastric bleeding.

On his arrival, his rectal temperature is measured at 39° and his blood pressure at 80/60. The CBC shows Hb 83 (N = 140-160). Arterial blood gas analysis shows: PO<sub>2</sub> 50 PCO<sub>2</sub> 65 pH 7.30.

Identify the 7 factors contributing to reduced tissue oxygenation in this patient and for each one specify the pathological physiology mechanism in question.

**DIGESTIVE SYSTEM (1990-1991)**

You are called to consult in the OR for a patient with abnormal bleeding. The surgeon informs you that the patient has cancer of the head of pancreas, which has wholly obstructed the bile duct. The patient has not eaten for 6 days and has been receiving a broad-spectrum antibiotic for 8 hours. The spleen has not increased in volume. Provide the most plausible explanation for this abnormal bleeding and recommend therapy.

**URINARY SYSTEM (1990-1991)**

A normal subject is put on a sodium-rich diet. After a few days, his weight has increased by 2 kg. Urinary excretion of Na is 250 mEq/d (normal rate is lower than 150 mEq/d). The sodium level is 140 mEq/liter.

- A. What mechanism in the proximal tubule would explain the observed level of sodium excretion?
-

- B. What mechanism in the distal tubule would explain the observed sodium excretion?  
C. Why is the sodium level normal?

### HEMATOLOGY-IMMUNOLOGY (1990-91)

A patient of 55 has to undergo surgery on the thigh. He drinks about 6 beers per day. Eight years ago, he underwent cholecystectomy without complications.

Laboratory tests:

		<u>Normal</u>
Platelet count	130 x 10 <sup>9</sup> /L	150 - 450
Prothrombin time (Quick's test)	15 sec	9 to 11 sec
Prothrombin time carried out with 2 normal plasma	10 sec	9 to 11 sec
aPTT (activated partial thromboplastin time)	40 sec	27 to 35 sec
Fibrinogen	2.30 g/L	2.0 to 4.0 g/L

Provide two possible diagnoses.

\* Average of all modes of evaluation

## Integrating the Learning of Medical Humanism into the Curriculum

Daniel J. Côté and Jacques E. Des Marchais

*Medical humanism consists of being able to  
deal with the patient as a whole human person  
- A medical student  
at the University of Sherbrooke*

In our country, public opinion reminds physicians ever more insistently that their patients are human beings who want to be listened to and understood as whole people living in their own settings, and not just treated as biological subjects. The increased number of lawsuits in the medical field is often viewed as eloquent testimony to this state of affairs. Many educators deplore how little room is assigned in medical education programs to other than scientific matters.

Medical faculties no longer have a choice. They must educate physicians whose head and heart respond in harmony to the expectations of suffering people. This is called for not only by the dignity of the individual but by the aspiration to deliver quality services. This is why we at Sherbrooke have chosen to make one of the three goals of the reform to the MD program *allowing students to develop their sense of humanism* in order to be able to demonstrate it throughout their careers.

Work on medical humanism began in the first year of the program's implementation (Des Marchais et al., 1988). An analysis commission specified the dimensions of medical humanism and the setting required for it (Johnson et al., 1988). Directors of the program also asked a consultant to review the humanistic dimensions of clinical skills, and this helped us in making progress on the road to integrating dimensions about the human being into this part of the program (Côté, 1989). During 1990 and 1991, two outstanding humanistic physicians, Professors Jean Bernard and Edmund Pellegrino, received honorary doctorates from the University of Sherbrooke. We presented the gist of our reflections to each one of them, confronting our own thoughts with theirs. This external validation had a major impact on the faculty.

It is not easy to talk of humanism in a faculty of medicine. The fact is, the perception of medical humanism varies according to your frame of reference, be it philosophical, sociological, anthropological, literary, psychological, historical, or so on. It is hard to reach consensus on the good and the true; we hence the importance of specifying an appropriate frame of reference, which, in turn, at least in the first stages, necessitates processes of an

intellectual nature. The reflection we conducted, a valuable one, led us to build up concepts, designed at first to aid those responsible for the program, later to enrich discussions with the teaching staff, and finally to stimulate the design of educational activities that were more interesting and more consistent with the goals of the reform.

What is medical humanism? Given the presence of certain facilitating conditions, can medical humanism be learned and developed? To answer these questions is to establish the theoretical basis of a frame of reference that will allow us to see how well the new MD program satisfies these conditions. After eight years' trial, perhaps we can cast a critical eye on activities in the program for humanistic learning: were the noble goals of the reform initiative fulfilled? What projects would favor continued development of medical humanism in the Faculty? In such a difficult field, it is necessary to demonstrate a certain idealistic optimism to countervail the excessive value placed on the technological aspects of medical practice.

## Medical Humanism

A surgeon and a medical student doing her clerkship come to see a patient aged 60 accompanied by her daughter. They inform the mother that she has cancer. At the moment when the news is given, the daughter of the patient dissolves into tears. Without prompting, the clerk draws her gently into a small adjacent room and spends twenty minutes listening to her and comforting her. The surgeon is astonished by this spontaneous and disinterested gesture.

*Medical humanism* refers to every physician's inner tendency to *see the patient as a human being and put the patient at the center of his or her professional concerns*. This presupposes *professional competency*, without which medical humanism is a mere illusion. An essential precondition to humanism is the quality of personal integrity. It constitutes the reassuring guarantee of the moral uprightness of a physician who is fully competent to exercise his or her art. Such physicians continually display a "personal commitment to be honest in assessing and maintaining their knowledge, skills, and abilities (Johnson et al., 1988)". And in particular, such physicians know how to recognize what they do not know or can not do.

We attach importance to professional competency stamped with integrity. Once these foundations are in place, medical humanism properly so-called can, as Pellegrino has said, be given expression in both its aspects, the affective and the cognitive (Pellegrino, 1974).

### *The affective component of medical humanism: Compassion*

Like integrity and mastery of competency, compassion is a social quality highly sought after in physicians (Pellegrino, 1974). It relates to the physician's willingness and ability

to understand the patient and be open to the patient's suffering. It takes the form of a set of behaviors that are, above all, empathetic and that find expression largely, but not exclusively, in physician-patient communications (Des Marchais et al., 1988). Signs of the humanistic nature of this relationship can be identified using a behavior-observation checklist. We have chosen one that was developed by Des Marchais *et al* (Des Marchais et al., 1990). using Flanagan's critical incidents technique (Flanagan, 1954) (Table I). Compassion infuses the expression *to care for* with its full meaning: to care, mindful of the conviction that "suffering and illness engender special needs for comfort and help (American Board of Internal Medicine, 1983)".

Table I. Observable behaviors in medical humanism

A physician who is concerned for the patient as a human being:

- approaches the patient in a personal manner;
- allows the patient to voice the reason for the consultation;
- makes judicious use of open questions;
- listens and looks with interest while the patient speaks;
- dedicates him- or herself fully to the interview;
- rephrases what the patient tells him or her;
- guides the interview in a consistent way;
- puts his or her conversation partner at ease;
- facilitates the expression of emotional matters;
- invites the patient to ask him or her questions;
- clarifies and synthesizes what the patient says;
- correctly formulates the patient's problems;
- respectfully requests the patient to cooperate in the examination;
- examines the patient with tact;
- expresses understanding of the problem presented to the patient in an appropriate way;
- responds appropriately to questions raised;
- communicates recommendations and the reasons for them to the patient well;
- maintains a non-judgmental attitude;
- reaches an agreement with the patient as to the follow-up to the consultation.

*The two cognitive components of medical humanism: The humanities and values*  
Pellegrino (Pellegrino, 1974) has done much to clarify the term humanism, which is liable to create confusion and controversy. Humanistic knowledge has two distinct branches: the humanities and values.

The humanities - a term which arose in the 19th century - represent an educational ideal based on language and on the knowledge of classical (Roman and Greek) literatures. Subsequently this term came to include skills that "free up" the human being: the ability to think, write, and speak clearly, tastefully, persuasively, and morally; the ability to invent; and the ability to create the beautiful and to judge it - in short, the skills acquired through "liberal studies (Pellegrino, 1974)". It was believed that contact with disciplines such as history, philosophy, and the arts favored the development of aptitudes of this kind. Although it is true that this branch of medical humanism is not obligatory and lacks the attractiveness of the modern-day concept of *compassion*, we agree with Pellegrino when he writes: We cannot permit the possibility of contact with traditional humanism to decay completely. Too much of man's capacity for a life of satisfaction is contained within it. We owe every student at least the opportunity for contact with liberal studies at some point in his education... in a variety of ways not limited to the premedical years (Pellegrino, 1974).

Studying the *humanities* is thus profitable, but does not alone constitute the basis of learning *medical humanism*: "Many esthetes, people who are keen on art and enamoured of beautiful things, feel very little concerned with human and social issues. Esthetic and humanitarian goals are far from always being convergent (Coté, 1989)".

Values - constituting the second branch of the cognitive component of medical humanism - have received more attention than the humanities (Mosley, 1989), if the number of medical faculties that have added medical ethics to their programs is anything to go by (Pellegrino, 1989; Self et al., 1989; Pellegrino et al., 1982; Bickel, 1986; Glover et al., 1986; Self et al., 1986; Barnard, 1988; Self, 1988). Modern society is in fact very sensitive to the intersection of values that occurs at every stage of a medical transaction (Pellegrino, 1974), whether between patient and doctor, the individual and society, or science and the art of medicine (Des Marchais et al., 1988). The study of values, known as axiology, relates to adherence by an individual or a community to a set of beliefs, choices, and priorities. It is thus very important, although for many teachers, at the time of treatment of an individual or community, it seems to have less of an *obligatory* nature than the acquisition of competence, integrity, and compassion. The fact is, "education in values, although a contributing part of education in humanism, is neither its point of departure nor its point of arrival (Coté, 1989)". Medical students do not study axiology, but it serves nevertheless as a reference point for the specifics of an education in values. Pellegrino writes:

The study of values may well provide a more realistic and a more widely applicable avenue for "liberal education" for today's medical students than ... traditional (or literary) humanism. Without deprecating the latter, it seems more likely that the study of human values will open a more attractive road toward attainment of those attitudes of mind formerly associated with the best in traditional humanistic studies (Pellegrino, 1974).

In reconsidering the area of values in light of the reflections of the American Board of Internal Medicine (American Board of Internal Medicine, 1983), we find it appropriate to encourage the student to develop respect for the values of others ("others' choices and rights regarding themselves and their medical care") (American Board of Internal Medicine, 1983). No era illustrates better than our own the daily relevance of axiology to all the thorny ethical decisions a physician must face: euthanasia, genetic manipulation, abortion, heroic measures, experimentation on human beings, and so on (Pellegrino, 1974).

*The dimensions of humanism: A synthetic definition*

Here, then, in brief, are the different dimensions of medical humanism included in our program. For purposes of a shared vocabulary and to present a synthesis of these dimensions, Table II offers an overview of the theoretical frame of reference that has won consensus at Sherbrooke.

## The Learning of Medical Humanism

The dimensions of medical humanism (Table II) are described by Pellegrino thus: The ideal encompasses two essential but distinct sets of components, affective, cognitive. They differ markedly in content; the one does not guarantee the other. In the best examples, they are complementary, but they may also be in conflict. Each requires a different mode of learning and teaching (Pellegrino, 1974).

It would be difficult not to acknowledge that a faculty of medicine has a social responsibility to develop compassion in future physicians. This responsibility calls for the learning of attitudes, and in particular the development of empathy and the art of physician-patient communication. In our Faculty, we also consider it important that values be learned through medical ethics, which belong in the cognitive domain (knowledge). To a certain extent, then, medical humanism can be learned (Pellegrino, 1974).

While granting that medical humanism is a part of one's identity, in the psychological sense, or could indeed be a character trait above all, there are many activities that can foster its acquisition. It is not as easy, however, as acquiring a simple knowledge base at an elementary taxonomic level. Medical humanism can certainly be learned, but in certain circumstances and only thanks to relations between these circumstances and other experiences. This is truly to make the claim that medical humanism is a legacy passed on from generation to generation of physicians (Johnson et al., 1988).

Table II. Humanistic dimensions

HUMANISTIC DIMENSIONS		<u>Weighting</u>
Dimensions preliminary to the exercise of medicine in a humanistic perspective:		
-	<b>PROFESSIONAL COMPETENCY</b>	obligatory
-	<b>PERSONAL INTEGRITY</b>	obligatory
Dimensions specific to medical humanism:		
-	Affective component: <b>COMPASSION</b>	important
-	Cognitive component:	
.	1st branch: <b>THE HUMANITIES</b>	beneficial
.	2nd branch: <b>RESPECT FOR THE VALUES* OF OTHERS</b>	obligatory
	for example, in medical ethics	important

- \* Values have a cognitive component but they also have an affective one. Respect for values within a society often constitutes something more than an «act of reason.»

In short, to provide for the learning of medical humanism, the Faculty must put into place conditions suitable to fostering the acquisition of both knowledge and attitudes. These conditions are generally well understood (Anderson, 1977; Rumelhart et al., 1977; Tulving et al., 1973; Anderson et al., 1979; Gagné, 1984; Jean et al., 1988). We should like to present here some that we consider to be particularly propitious. A list of this kind should enable us to see whether, in general, conditions suited to facilitating the acquisition of the cognitive and affective dimensions of medical humanism have been fully provided for by the new program's teaching activities.

To facilitate learning of the cognitive component (knowledge, education in values, medical ethics), it is generally recognized that:

- *Students must be put into contact with humanistic values by:*
  - causing needs to come into being: the first facilitating condition is that students be sensitized to the necessity of ..., the importance of ...;
  - informing them, but imbuing every message with the emotional impact appropriate to the activity as well as persuasive logic; and by repeating this often;
  - fostering analysis and discussion of these values, for example in PBL tutorials, case-study discussions, and seminars; in short, by using a whole range of methods that are not only concrete, personal, and immediate, but are founded on the insights of

cognitive psychology. This discipline has shown that cognitive learning is enhanced if a stimulus is provided at the beginning of a learning activity, prior knowledge is reactivated, and the student has an active participatory role.

- *Credible teachers must be chosen, as inevitably they will be seen as role models of medical humanism.*
- *Appropriate, immediate, sustained feedback must be supplied on the student's performance and on progress made in learning about values.*

To facilitate acquisition of the affective dimensions (attitude, compassion, empathy, communication):

- *Compassion must be demonstrated:*
  - in the MD program itself, whose organization and daily content must be "humanized" to make it into a system concerned with the student as a human being; and
  - within the teacher-student relationship, in particular in that involved in aid to learning during tutorials and clinical clerkships.
- *Students must be allowed direct enjoyment of human experiences likely to bring success and pleasure, a fundamental postulate of the teaching method in the immersion rotation.*
- *Personal reflection must be fostered in students by:*
  - enabling them to "own" the objective, through group discussion designed to develop social consensus around humanistic behaviors. This discussion will also provide a good opportunity to experience and to share the affective dimension of medical humanism. (*Cause certain needs to come into being.*)
  - complementing such reflection with written or oral information. (*Present a message that is both logical and emotional.*)
- *The clinician-teacher (as a living, breathing role model for humanism) must be assigned the main role in transmitting compassionate attitudes. "The clinician-teacher has truly awesome responsibilities here. One careless action at the bedside will undo hours of lecturing about the dignity of patients (Pellegrino, 1974)". (*Bring into contact with models.*)*
- The value of suitable feedback must be recognized in strengthening the desired attitudes. (*Offer appropriate feedback.*) Since any proper feedback must be descriptive, and attitudes can only be inferred from observed behaviors, the facilitator should use grids for observable humanistic behavior (Table I).

The different conditions that facilitate specific learning of medical humanism are listed in Table III.

### *Conditions for learning medical humanism*

We have just seen how conditions facilitating the learning of medical humanism have been revised. The question remains, however, whether there is agreement between these and the teaching activities put forward by the reform of the MD program.

The reform would first have humanistic learning spread throughout the program’s four years, so that the students’ intellectual and affective growth can come into play, and indeed even be accelerated (Faculty of Medicine, University of Sherbrooke, 1987). This approach allows students more opportunity to progress at their own pace. It requires, however, that the Faculty take a very early position in favor of humanism and make it one of the major goals of the reform. Only thus will it elicit individual commitment, foster the promotion of humanistic dimensions (while developing a clear perception of the targeted objectives), and prompt individuals to make the humanistic choice. This is quite apart from the modeling influence that the Faculty will have on all its members in so doing. Moreover, the very process of implementing the new program promotes the overall blossoming of humanistic dimensions; it creates a context of receptivity to change in general as well as to humanism; it gives students and teachers permission to formulate critical judgments and even to examine subjects of study that are other than biological. Particular structures and activities contribute more specifically to the acquisition of humanism.

Table III. Conditions that facilitate the laerning of medical humanism

	DOMAIN	
	<u>Cognitive</u>	<u>Affective</u>
- Cause a need to come into being.	x	x
- Present a message that is both logical and emotional.	x	x
- Analyze values.	x	x
- Bring students into contact with models.	x	x
- Provide appropriate feedback.	x	x
- Humanize the program itself.		x
- Introduce compassion into the helping relationship (between the teacher and the student).		x
- See that students have fruitful human experiences.		x
- Present opportunities for developing social consensus.		x

*The PBL method*

Many people believe that Problem-based Learning is favorable to both cognitive and affective learning of medical humanism.

*Cognitive*

PBL contributes greatly to fulfilling the third facilitating condition for the acquisition of medical humanism. (*Analysis of values.*) Problem analysis and small-group discussion promote acceptance of the values of peers. There is also the content of PBL: not only does the tutor ensure that the humanistic aspect of problems is emphasized; certain problems are themselves slanted in a humanistic direction (Table IV). Not that such problems are numerous, nor can it be said that enough tutors are significantly concerned with them. Nevertheless, in 1991-92, a resource person helped every PBL unit leader to broach a problem with humanistic components whose concepts are included in the *Tutor Handbook*, thus obliging adequate group discussion to occur in tutorials.

Table IV. Some examples of PBL problems with a humanistic slant

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The stages of preparation for dying
Ethical considerations in screening programs
The impact of loss of autonomy on the patient and family
Suicide
Bereavement
Confidentiality in AIDS cases
Epilepsy: humanistic considerations
Myelomeningocele: family support, problems integrating the child, repercussions on the family
Therapeutic abortion
Sexuality through the ages

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*Affective*

The "format" of tutorials is in itself an "opportunity" for humanization. Instead of dealing strictly with disciplinary data, knowledge, and diagrams, students find themselves in constant contact with what awaits them as future physicians: the human being - even if only in the «paper» version of PBL problems. Students work in teams six hours a week, interacting intensely with their peers, sharing information, and engaging in the confrontation of values. These all represent opportunities to develop the ability for communication and mutual support, and indeed, the qualities of compassion and empathy, especially in stage 9, that of the group's self-assessment on its operations.

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The PBL method also promotes the development of group consensus (*Present opportunities for developing social consensus.*), especially when the problem under study has humanistic or psychosocial dimensions. The presentation of the problem and the group's contributions can easily sensitize participants to humanistic aspects (*Cause a need to come into being.*) and allow for information to be fleshed out (*Present a message that is both logical and emotional.*). Finally, the interactive, dynamic, diversified, open features of PBL contribute to humanizing the program (*Humanize the program itself.*). More than this, PBL offers students a good deal of time that they must manage themselves. Education is no longer detached from the other sides of life, since students have more control over their lives and their other needs.

The tutor is not an uninvolved spectator in this approach. Tutors contribute to the acquisition of information (*Present a message that is both logical and emotional.*). They may contribute help (*Introduce compassion into the helping relationship.*). They most assuredly act as role models (*Bring students into contact with models.*) and provide feedback (*Provide appropriate feedback.*). As an experiential cognitive process, PBL unquestionably elicits pleasure among students (*See that students have fruitful human experiences.*), a dimension that is recognized by all who make use of the approach.

In short, in its own way the PBL method in theory makes a contribution towards all the conditions that facilitate the acquisition of humanism (Table VI). This great potential rests, however, on a third condition indispensable to the teaching system: namely that tutors fulfil their role appropriately.

### *Introduction to medicine*

Particular attention must be paid to the first two weeks of the first year, since they hold strategic importance. Expectations are great, and a suitable tone must be set. For this reason, the *Introduction to Medicine* presents a holistic approach to medicine that integrates all the different aspects of the human being (physical, psychological, social, and spiritual) and assigns special importance to the physician-patient relationship. In this light, physician and patient are presented as partners in search of the best solution in the circumstances. This introduction also emphasizes the constant search for a balance between art and science, two inseparable components of a truly holistic medicine. Concretely, this introduction consists of two tutorial sessions in which the student being initiated to PBL achieves awareness of concepts such as *health-disease*, *quality of life-autonomy*. A group of tutors are assigned the responsibility of guiding students towards proper use of PBL and introducing them to the dimensions of medical humanism, at the same time acting as role models, which are essential at this departure point (*Bring students into contact with models.*).

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### *The clinical immersion rotation*

The clinical immersion rotation, which was put into place as part of the reform, represents a unique opportunity for the student to experience medical humanism on a daily basis. It is an activity that students derive much pleasure from (*See that students have fruitful human experiences.*) and gives rise to a variety of experiences (Des Marchais, 1980).

Lasting three weeks (Faculty of Medicine, Université de Sherbrooke, 1987; Des Marchais, 1980) at the end of the first trimester (December) of the first year, this rotation allows students to practice in a primary-care hospital where there is no hierarchical residency pyramid. The aim of the rotation is to allow for a discovery of the human through patients, physicians, and medicine itself. Serving as a humanistic experience par excellence, the rotation allows plenty of room for student autonomy. Students decide for themselves on learning opportunities with physicians, following a week's experience as a nursing assistant. Subsequently, most students broaden their knowledge of medical practice by going into private practice, industry, or social service. They there identify a series of health problems and gauge the commitment of physicians to the community. In this way, students discover the human aspects specific to various modes and venues for the practice of medicine. They are placed in a better position to define their own needs in regard to medical humanism (*Cause a need to come into being.*).

During the rotation, students closely observe the clinician's lifestyle, all the while establishing a human relationship with him or her (*Introduce compassion into the helping relationship between teacher and student.*). It is through the physician that students make their first contacts with their future profession. An indelible image of the role of physician will remain with them from this experience (*Bring students into contact with models.*).

During the rotation, the student receives educational supervision from a local facilitator as well as a Faculty facilitator. The latter is a full-time teacher who meets with a group of five to seven students before, during, and after the rotation. This teacher follows a structured procedure allowing for *the completion of the information acquired by the student* (Present a message that is both *logical and emotional.*) and the structuring of feedback (Provide appropriate feedback.). It is above all during discussions with peers, however, that students are enabled to arrive at and take ownership of *consensus on humanistic behaviors in the rotation* (Present opportunities for developing social consensus.). Students keep a logbook where, at the end of each day, they analyze the day's events and write down comments and reactions *to situations. They note and comment upon their findings* (Analysis of values.), think about future *behaviors, and identify their models for clinical practice* (Bring students into contact with models.). In their final report, students draft a personal summary of the gains they have made. This summary is used in assessing the activity.

The clinical immersion rotation continues to receive favorable responses. Students' comments emphasize how *agreeable, individual, and free* this mode of learning is

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(Humanize the program itself.); they testify above all, however, to the deep personal satisfaction derived from a *significant, valuable, motivating, and appropriate accomplishment* (See that students have fruitful human experiences.). In a word, the clinical immersion rotation aids in the affective learning of medical humanism by *contributing to all the facilitating conditions* (Table VI).

### *The clinical skills unit*

The clinical skills unit (chapter 4) is structured so as to take the student a good way along the path of affective and cognitive learning of *medical humanism*.

- The very title of the activity, Communication and Humanism, repeated twice per month, is a clear statement of the Faculty of Medicine's philosophy and the targeted objective. Bujold (Bujold et al., 1982) has shown that the simple fact of clearly stating the attitudinal goals of a learning activity contributes to students making these attitudes more definitively their own.
- Besides allowing the student the *opportunity for direct experiential learning of compassion* (See that students have fruitful *human experiences*.) within a *framework that is structured (Analysis of values.)*, *scaffolded (Introduce compassion into the helping relationship between teacher and student.)*, and supervised (Provide appropriate feedback.), this unit remains the only one to specifically emphasize the aspect of physician-patient communications, seen as a humanistic art that it is possible to learn.
- Photocopied notes and bibliographic references aid students in *adding to their knowledge base about the main themes dealt with* (Present a message that is both logical and emotional.): the student confronting the role of learner, and then in a hospital, well on the way to becoming a physician. Students explore the state of being a patient, the experience of disease, attacks on one's physical integrity, and the attitude of the physician to individual privacy. Sessions on respect, confidentiality, privacy, and multidisciplinary are also offered. This learning activity closes on the themes of compassion, suffering, crisis events, chronicity, palliative care, and death.
- At many group meetings, students can contribute to the creation of consensus on humanistic behavior and the rules of good communication, especially by means of role-playing activities involving group decoding. In each session, *the role-playing activities take up the theme under study* (Present opportunities for developing social consensus.). The very context contributes to the student's *experiencing a need to develop humanistic behaviors* (Cause a need to come into being.). The facilitator assigned to a group for a whole trimester must *be fully aware of his or her influence as a role model* (Bring students into contact with models.). Indeed, the way the unit has been implemented promotes the distribution of role models who value humanism across the Faculty. Each year, the Faculty invites new teachers, and has all the clinical departments participate in the unit. In this way, continuity of the message during postgraduate study is assured.
- This longitudinal unit is spread over the two years of the preclinical phase. In this way, it ties in with the student's affective and intellectual growth, and indeed promotes it. The writing of entries in a structured journal, the logbook, following every communication

experience, allows the student to go back over his or her performance and emotions and set objectives for personal growth. Students consider this activity to be a fine example of things that can be *done to make the MD program* more agreeable to get through (Humanize the program itself.).

In a word, the clinical skills unit contributes to each and every one of the conditions that *facilitate the learning of medical humanism* (Table VI).

### *The clerkship*

The new model for the clerkship, the second component in the reform (Chamberland et al., 1992), does not contain activities specifically designed for the acquisition of humanistic behaviors, unless you view the application of skills mastered earlier on in this light. Nevertheless, it has great potential. It is during the clerkship that the clinician-teacher can truly exercise, daily, *in-depth, and continuously, an influence as a role model* (Bring students into contact with models.) *and as a source of descriptive, formative feedback* (Provide appropriate feedback.) *about the helping relationship with the patient* (Introduce compassion into the helping relationship between teacher and student.). All these things are expected of a humanistic teacher. It is truly during these numerous person-to-person contacts that the clerk will be able not just to express *and practice the humanism learned during prior education* (See that students have fruitful human experiences.), but also to engage in self-assessment and *define his or her own needs for improvement in this area* (Cause a need to come into being) (See Table VI).

It must be said, however, that the clerkship contains many educational pitfalls (Chamberland et al., 1992)! We have all *heard traditional* criticisms about the clinical clerkship: dehumanizing way of life, excessively focused on bureaucratic requirements; too much clinical work to allow for the deepening of, and reflection on, knowledge; absence of effective supervision and support; teacher feedback that is too often negative and strictly evaluative; bosses who are sometimes anti-role models; "fine examples" of diseases whose rarity draws attention away from the patient.

These pitfalls are the flip side of the strengths of the clerkship. Can a way be found to prevent the investment in humanism from being canceled out through contact with clinical "real life", with all its daily tensions and performance requirements? It is hard to change physicians already in practice, but might it not be possible to influence them via generations on their way up? And could not the humanism developed during the years of preclinical training ripple out into the clerkship to the postgraduate level and even into the practice setting itself, since *the same group of teachers intervene* at all these levels?

### *The ethics and medical law course*

It may appear that learning activities in the new program place the emphasis above all on the affective component of medical humanism; that is, on compassion expressed through

empathy and communication. What then of its *cognitive* component, *specifically* the branch relating to values as fulfilled in medical ethics? (Table VI)

Medical ethics studies the human values that inspire the conduct of physicians and thus help them provide rigorous support for the positions they take and the choices they make, through a set of structured principles rather than intuition and arbitrary judgments. The study of values opens a person up to attitudes that are better suited to the context of modern medicine; and while it is true that axiology or the *science* of values deals mainly with humanistic concepts (knowledge), it also leads to attitude.

The Ethics and Medical Law course forms part of the activities of the pre-clerkship. During the twelve hours assigned to this course, the ethical and legal aspects of medical decisions are presented. The dilemmas that students face go well beyond the medical, technical, and biological framework, taking in ethical, legal, and social considerations. The integration of ethics with law thus better reflects the reality of medical decision making. Furthermore, in our view, it is important to bring out the similarities, differences, and *limitations of law* and ethics, two distinct fields that share a single goal: the promotion of a system of values.

The course includes activities that cover some concepts in medical ethics; for example, a physician's social obligations, the code of ethics, enlightened consent, cessation of treatment, and medico-legal liability.

The teaching of ethics must exceed simple sensitization (*Cause a need to come into being.*) and ultimately lead to *the acquisition of conceptual skills in ethical reasoning* (Present a message that is both logical and emotional.). *That is why* it includes several types of learning (Analysis of values.): individual readings, written reflection, lecture courses, small-group work, lectures, forums, discussions of case studies. *In all these ways*, students participate *in the search for social consensus on humanistic values* (Present opportunities for developing social consensus.). By identifying their own values and those of others, students come to realize that any medical decision contains a judgment linked to a range of values. Over the course of these discussions, students feel called upon to analyze the varied perspectives of philosophers, jurists, theologians, and others.

For these activities, particular attention is paid to the *credibility of teachers, who will inevitably be seen as role models* (Bring students into contact with models.), *as well as to formative student assessment* (Provide appropriate feedback.) which offers a key opportunity for reflection that ought to result in an individual organization of values suited to medical decision making.

Within the program, the course plays a mirror-image role to that of the clinical immersion *rotation, but at a higher conceptual and cognitive level.*

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*The humanities*

Have we forgotten the humanities branch of the cognitive component in medical humanism? (Pellegrino, 1974). Not *entirely*. We chose to consider this field beneficial but not obligatory. But, following Pellegrino's example, we refuse to allow the disappearance of this source of enrichment ("too much of man's capacity for a life of satisfaction is contained within it") (Pellegrino, 1974).

How best to respond to this challenge in the contemporary socioeducational context? The answer: through a series of optional lectures (Table V) open to all the faculty, students in both the MD and postgraduate programs and staff in the Faculty and the university hospital. Attendance at lectures on ethical and legal subjects has been very high; it has been much lower at lectures on the history of medicine, which are more closely tied to the field of the humanities. Alongside these, students are invited to participate in a *series of activities offered* to the Faculty of Medicine by the Fonds du patrimoine (heritage fund); among these are art exhibits held three times a year.

Activities of this kind are *well suited to enrich students' humanistic knowledge base* (Present a message that is both logical and emotional.). Better still, what young student, made keen by the life of a great physician, would not be motivated to become him - or herself a better physician? *Contact with the humanities thus contributes to the condition "Cause a need to come into being"*. (Table VI).

*The sponsorship system*

In 1987, to offer support to students many of whom are isolated from their family and social settings, and to help them maintain close contact with at least one teacher, the Faculty set up a sponsorship system. Many teachers volunteered to participate, although no remuneration nor operational framework was provided for the work. Sponsors meet four protégés assigned at random, when and in the manner they prefer: at a restaurant, informal lunches, meetings in the faculty common room, athletic activities, care extended by the teacher's family, and so on.

These activities, which have no predefined time limit, can serve to bring students into contact with models and provide for a helping relationship between teacher and student. The sponsorship has not yet reached *cruising speed*, however; it too often occurs sporadically.

*The course on interdisciplinarity*

Humanistic medical intervention has not been made any simpler by the fact that holistic medical care must deal with several disciplines. Young physicians must prepare themselves for interdisciplinary work. Several teaching formulas linking the preclinical program to specialty training in the workplace have been tried here and there, with varying success.

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Table V. Titles of faculty lectures with humanistic content during 1990-1991 and 1991-1992

*Lectures on ethical or legal subjects:*

*Euthanasia: a medical and legal approach*  
*The progress of biology and the definition of the human being*  
*Professional ethics and AIDS*  
*Humanism and technology*  
*Cessation of treatment*  
*Enlightened consent: a new social contract*  
*Sexual assault concerns us all*  
*Severe anemia in a Jehovah's Witness patient in childbirth*  
*Resuscitation and non-resuscitation*

*Lecture series on the history of medicine:*

*The moral consequences of progress in biology and medicine*  
*Alternative medicines*  
*The history of aspirin*  
*Norman Bethune*  
*Claude Bernard (1813-1878): are his principles to be found in the MD program?*  
*From magic to molecular pharmacology*  
*Cushing and neurosurgery*  
*A century of cardiology*  
*William Harvey and the discovery of the circulation of the blood*  
*An overview of the history of endocrinology*  
*Rheumatoid arthritis and art*  
*The first cancer treatment center in the world: Reims and Jean Godinot*  
*Cholera and O'Shaughnessy, 1880*

Training in an interdisciplinary approach is taking root with the new program and coming to be progressively modified. Teaching methods are still experimental in this approach. The length of the session, the people who teach it, and the framework for education are slowly changing.

At the start, six hours of training were given, in two clinical-skills sessions, simultaneously to students in the Bachelor of Nursing Sciences and second-year medical students. For the

nurses, who already had a few years of professional experience, this training formed a part of a 45-hour course. The sessions included problem solving in a two-discipline small group and theoretical presentations on interdisciplinary operations and professional roles, in the presence of professionals who were already members of interdisciplinary teams. Discussion periods on perceptions of existing and hoped-for relationships between the two professional groups were provided for. Medical students appreciated this training, but asked for more contents and contacts with other professionals working in the field of health.

The second version of interdisciplinary training was given as a single 45-hour course offered simultaneously to students in the Bachelor of Nursing Sciences and third-year medical students. In addition to benefiting from the methods that were already in place, students now used a logbook and received enriched theoretical training. They also were called upon to prepare an oral presentation and a piece of written work. Despite the high quality of the teaching instruments used, medical students feared investing time in this course during a trimester dedicated to complex problems (unit 14) and at the expense of developing their problem-solving abilities and acquiring therapeutic skills. Their participation was thus somewhat attenuated.

The goal of the course was to render students better prepared to work harmoniously and efficiently with other health professionals, so that patient needs are satisfied. Its specific objectives related as much to knowledge (for example, identifying factors favorable and unfavorable to interdisciplinary work and describing effective action strategies) as to attitude (for example, acknowledging one's own role and resources and one's values and limitations as a person, as a professional, and as a member of a group).

The teaching approach adopted emphasized small-group work. The course required exercises based on videos, clinical case studies, and direct observation. Students compared opinions. Obligatory readings complemented the exercises. The logbook became the instrument for integrating new knowledge. In this way, students broached themes such as small-group management, initiation to activities conducted by other professions, physician-nurse cooperation, and observation and analysis of the operation of an interdisciplinary team in order to arrive at an interdisciplinary solution to a problem. At the end of the course, students made an oral presentation and submitted written work produced by a team as well as individual texts. They also sat a written exam.

Since 1991, third-year students have been mastering roughly the same theoretical material as before, but through self-directed learning followed by nine hours dedicated to the clinical application of interdisciplinarity. They engage in medical assessment of an elderly person in a geriatric setting and participate in the assessment made of the same person by another professional from his or her own point of view (nurse, occupational therapist or physiotherapist, social worker, psychologist, etc.). This puts these students in contact with interns and clerks from different disciplines. They then participate in the interdisciplinary meeting of the department that is treating their patient. Last, they share their perceptions of each person's role and of their experience.

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The course on *interdisciplinarity* promotes analysis of humanistic components (*Analysis of values.*), provides information (Present a message that is both logical and emotional.), and offers numerous opportunities for feedback (Provide appropriate feedback.), especially by students in other disciplines. It also offers opportunities for hands-on experience (See that students have fruitful human experiences.) with multidisciplinary professionals and fosters the development of consensus (Present opportunities for developing social consensus.).

The changes made to this core represent responses to student needs. The goal of these changes was exclusively to enhance student participation in managing their own education. They constituted an incomparable opportunity to motivate the students.

Table VI displays an overview of the alignment between activities in this program and conditions that facilitate the learning of medical humanism.

If a student has succeeded in learning from each of these activities, it may be assumed that he or she will emerge significantly altered by the experience. But setting aside this theoretical analysis, are our students genuinely more humanistic at the end of their medical education? Do they really learn medical humanism in the course of their MD studies? Do the activities designed for the learning of humanism have the desired impact?

Before answering these questions, we should note that the integration of humanistic dimensions into the program has already resonated in the Program Coordination Committee. In spring of 1991, this committee adopted an operational definition of elements that show humanistic behavior. The four components of this definition were adopted from the training offered in the MD program (Table VII). What is found there are the different elements that are actualized in the physician-patient relationship, which now becomes the focal point of medical humanism.

## Assessing the Learning of Medical Humanism

In analyzing the dimensions we have just described, one finds that the structures and learning activities put into place from 1987 are very well aligned, at least theoretically, with the conditions presented in the scholarly literature as facilitating cognitive and affective learning of medical humanism. Some of these conditions were already present in the initial structure of the new curriculum. It was desired that they should have time to take root before speeding up the process of development of medical humanism.

In 1991 we began to wonder if the learning activities had the desired impact on our graduates. At the time when we started to take this critical look, our first students, who had been admitted in 1987, had just completed their fourth year in the MD program. We therefore had data available with which to evaluate training activities related to humanism: PBL, the clinical immersion rotation, the clinical skills unit, the course on interdisciplinarity,

Table VI. Alignment of activities in the MD program with conditions that facilitate the learning of medical humanism

	PBL tutorials	Clinical immersion rotation	Clinical skills unit	Rotations during clerkship	Course on Ethics and Medical Law	Humani- ties	Sponsorship system	Interdisci- plinary
Facilitating conditions for the learning of the cognitive portion of medical humanism: analyzing components	+++	+	++		++			+
Facilitating conditions for both cognitive and affective learning of medical humanism: experiencing the need receiving information coming into contact with models appropriate feedback	+ + + +	+ + ++ ++	++ ++ ++ ++	+  ++ ++	+ ++ + +	+ +	++ +	+  +
Facilitating conditions for affective learning in medical humanism: "humanized" MD program helping relation between student and teacher experience developing a social consensus	++ + + ++	+ + ++ +	+ + ++ ++	  ++ +	+   ++		+ ++	++  +

the course on Ethics and Medical Law, and the sponsorship system. We had to wait to obtain data on the clerkship.

As of 1989, we had already asked an expert in humanistic education to examine our program. His report (Coté, 1989) recommended emphasizing student contact with humanistic information so that students' pattern recognition would be fostered, and stimulating learning potential through deliberate reflection. He suggested adding self-directed learning modules and intensive workshops on humanism, and he invited the Faculty to set up some form of supervision and training for teachers of the subject.

Besides this, in April 1991, in order to involve students in the process of evaluation, we conducted a survey of the 1987-91 and 1988-92 cohorts. Seventy percent of students in the first cohort and 50% of those in the second sent in anonymous replies to a questionnaire. They were asked to evaluate how humanistic concepts were integrated into discussion during tutorials, to cite the three activities that had contributed the most to their acquisition of humanism, to describe medical humanism, to evaluate certain assertions about the pertinence of humanistic teaching during the preclinical period, and to formulate suggestions.

Irrespective of cohort, 70% of respondents considered the preclinical phase to have supplied a sufficient number of opportunities to learn humanism. The same proportion of students felt they had acquired enough medical humanism to make it unnecessary to add other activities towards that end.

*For these students, medical humanism consisted of: not judging; harmonious coexistence; being ready to listen to others' needs; establishing a good relation with the patient and the patient's setting; succeeding in understanding the patient; viewing the patient holistically; understanding his or her perceptions; not letting the patient be eclipsed by the pathology; displaying patience, an absence of prejudice, and open-mindedness; displaying respect, a readiness to listen, and empathy towards others; bearing in mind that one is treating a person and not a pathology; doing unto others as we would have them do unto us; seeing the patient and his or her overall wellbeing as one of our own priorities; being able to deal with the patient as a total human person; helping the person and not just the person's body; maintaining respect for individuals, their basic rights, and their values; displaying empathy and respect.*

### *The PBL method*

Many teachers acknowledge that numerous modifications will have to be made to the PBL method to improve the humanistic approach. However excellent it may be, it does not appear that the PBL method as currently applied by us is being exploited to maximum potential. In particular, we must teach students to offer feedback (even when disagreeable) and share the feelings experienced in the small group with their peers. As well, the supervision provided by the tutor regarding the humanistic dimension of problems can

Table VII. Demonstrating humanistic behaviors

Medical humanism puts into practice the physician's inner tendency to place the patient as human being at the center of his or her daily concerns. This attitude is expressed in respect for the individual's freedom, dignity, values, and belief systems. The human being becomes the center of the concerns and decisions of the physician's professional life.

A student demonstrates humanistic behaviors through:

1. communicative skill and the ability to listen;
2. intellectual integrity towards oneself and others;
3. respect for the values of other people;
4. an empathetic and judicious manner of responding to a problem or need.

The first two characteristics can be seen as prerequisites. Nevertheless, acquiring them is so essential to the demonstration of humanistic behaviors that they must be listed and perceived as forming part of a hierarchical order. Thus it might be said that communicative skill and intellectual integrity are qualities essential to a physician, while the addition of respect for values and empathy are the distinctive characteristics of a good doctor. Let us look at each of these characteristics in detail.

**1. COMMUNICATIVE SKILL AND THE ABILITY TO LISTEN**

Knowing how to conduct an interview remains a key skill in gathering information and all the data about a problem. But the concept of communication invoked here goes beyond the technique of using a questionnaire and embraces other aspects of the physician-patient relationship. Students who display this characteristic do not just ask questions but also listen and react. Their approach is holistic, and for them the sick person is more important than the sickness she or he is suffering from. This mastery of communicative skills applies to relations with patients and their families, colleagues, teachers, and other health professionals.

**2. INTELLECTUAL INTEGRITY TOWARDS ONESELF AND OTHERS**

This relates to a personal commitment by students to be honest and rigorous in assessing their own knowledge and skills. Students should feel at ease in saying «I do not know» and in calmly acknowledging their limitations and taking measures to compensate for them.

**3. RESPECT FOR THE VALUES OF OTHER PEOPLE**

Accepting the choices made by others presupposes an interest in knowing about the scales of values of other groups. These values can vary according to ethnic origin, religion, age, sex, social status, and education. In a multiethnic society like that of Quebec, students will come face to face with a whole range of different cultures, each one imbued with its own range of values. Further, respect for the values of others means a commitment to listening and understanding the other person's point of view and ultimately respecting their rights and choices.

**4. AN EMPATHETIC AND JUDICIOUS WAY OF RESPONDING TO A PROBLEM OR NEED**

Empathy is defined as the ability to identify with another person, to grasp intellectually what that person feels, and to put oneself in the other person's place. It will be evident in students if they evince a primary concern to offer the other person help, placing themselves at the service of others without prompting, and not just treating patients but also caring for them.

The actualization of humanistic behaviors described above does not arise from the spontaneous maturation of innate qualities. It calls for an active process in which the student takes ownership of new learning, not just about attitude and know-how, but also about the judicious application of knowledge specific to this dimension. Appropriate assessment, by providing a structured measure of progress for each of the components specified, gives students the necessary data to advance their process of medical humanistic learning.

vary enormously from group to group and could benefit from greater standardization. Better training of tutors in the area of humanistic dimensions could partially meet these needs. Professional development workshops sometimes address these dimensions, as well as improvement of phase 9, group self-assessment. Moreover, peer assessment during unit 14 in third year was introduced in 1989 (See Chapter 2).

In the survey of students, they were asked to say "For each unit in tutorials, what percentage of the problems led to significant discussion of humanistic dimensions?" According to their responses, several units feature a notable percentage of humanistic concepts that ought to be discussed in tutorials (See Table VIII).

Table VIII: Percentage of humanistic concepts discussed during PBL units

Approximately 15%	Medical biology
Approximately 30%-40%	Nervous, musculoskeletal, urinary, and digestive systems
Approximately 40%	Respiratory, cardiovascular, endocrine, reproductive systems; infectious disease; hematology
Approximately 60%-80%	Psychic, growth-development-aging, community health.

The study led to the observation that the units with a larger humanistic component were all found in the program's first year. While it is true that increased contact with humanistic values is strategically wise at this juncture, the Faculty of Medicine considered it important to see that this aspect of medical education was better distributed across the duration of the program. On another front, the results provide no indications of the quality of discussions around humanistic dimensions. However, over half the respondents considered that tutorials represented the right time and place to discuss humanism. Many teachers, and those responsible for running the program, were astonished to learn of this perception.

*The clinical immersion rotation*

The clinical immersion rotation, which was already very much appreciated by students, nevertheless underwent major additions related to humanism. The program directors wished to supply better scaffolding for the humanistic undertaking. They stressed humanism with the educational facilitators, inserted bibliographical references about it into the student's rotation document kit, and sprinkled questions of a humanistic nature, in particular about empathetic experiences during the clerkship, through the final report. The report itself now included a section in which students were asked to put themselves in the place of the patient, the physician, and other members of the medical team. Since

1989, student responses have shifted from simple description to internalization. Facilitators are in a position to assess the determining influence of the rotation on students' humanistic perceptions. Students' comments are now marked by their humanistic reflections. Here are some examples drawn at random from rotation reports:

The patients often needs to speak, be listened to, comforted, and encouraged. It is important for the patient to have people such as members of the family and friends in his or her surrounding. The patient needs to preserve morale and be understood. Patients suffer in their own way; some suffer in silence while others complain.

When you are sick, you have to face the facts. The truth is that being sick means that to a greater or lesser extent, you lose your autonomy and become dependent (to the degree that you consent) on a care team. It entails fear of dying, the pain of feeling useless, the loss of quality of life.

Being involved in patient care makes it possible to establish an easy initial contact with patients. I found it important to begin by gaining the confidence of patients so that they would then allow me to gradually make my way into their world. Often a smile opens the first door, and understanding and the willingness to listen do the rest ... It is surprising to see how easy it can be to become compassionate.

With this gentleman who had just had an infarct, but who had an amazing sense of humor about his condition, I laughed and laughed and laughed. I feared for the life of a newborn they were trying to save. I sympathized with an elderly lady who had just learned that her sister who was hospitalized did not have long to live. I chatted with patients who had a great need to express themselves. In short, I could run through the whole list of situations I experienced, but they can all be summed up in a few words: sensitivity, rationality, humanity.

In the survey cited above, the clinical immersion rotation was ranked second among activities that contributed the most to the gaining of a medical humanistic perspective (32% of respondents). For the Faculty of Medicine, this rotation has fulfilled *its promise regarding the development of medical humanism*.

### *The clinical skills unit*

The clinical skills unit (See Chapter 4) dedicates a great deal of time to small-group discussions (at least two three-hour sessions per month over two years). This activity leads students to reflect on their experiences and share prior experience and what they have just been through in connection with the physician-patient relationship. How were we to assess its impact while taking account of the relative nature of any measurement of the humanistic dimension of medicine?

We proceeded in two ways. First, during objective structured clinical examinations (OSCE), short videos are shown presenting situations in which the student is required to recognize humanistic components, both through verbal and non-verbal communication, for example, by detecting the stage of denial of the disease in a patient. Results have been very satisfactory.

Secondly, at the moment of beginning the clerkship, the survey of students asks the question: "What three activities contributed the most to your humanistic learning?" In the response, 80% of new clerks say that the clinical skills unit prepared them to understand the sick person, communicate appropriately with him or her, and fulfil the humanistic dimensions of their role as future physicians. Moreover, 85% of respondents say they make an effort to respect these dimensions in their clerkship activities. Last, the replies indicate that 64% of teacher-clinicians take time over the humanistic aspects of their practice.

Although the Faculty has not yet conducted evaluation procedures on the medical humanistic "finished product", the managers of the program have reason to be highly satisfied with the impact of the clinical skills unit on the first cohorts of students. There is room, however, for improvement in teachers' support to students. A "companion-guide" might provide more stable scaffolding and enhance the clinician's function as a role model.

#### *The course in ethics and medical law*

This activity is essentially aimed at a single cognitive component of medical humanism. It includes an assessment of the ability to recognize the ethical and legal dimensions of medical decision making. The assessment consists of some ten MCQs and PAQs. In general, the results of this exam suggest that these notions are being relatively well mastered.

Students are given an opportunity to evaluate the course by means of a questionnaire. It would seem that all the themes presented to them are considered important; 74% consider the course relevant to their future practice and in general, individual comments express student satisfaction.

In the light of these comments and of past experience, we would like to see greater discussion of an ethical nature running through all PBL units, through in-depth treatment of one theme particular to each unit. A concentration of themes about medical law would still be preserved as a component of the pre-clerkship. It is a question of making the ethical dimension an integral part of medical concerns without submerging it in the purely medical aspects of the problems studied.

Although it is too early to know the impact of this kind of learning on future graduates' practice, it is already possible to observe new clerks in clinical rotations displaying an

interest in the ethical aspects of the situations they face daily. Their way of perceiving *the patient's values* seems to have undergone a change.

#### *The sponsorship system*

A survey conducted one year after the implementation of the sponsorship system revealed that by third year, scarcely 30% of students continued to engage in activities with their sponsor. Several no longer even remember his or her name. And yet the system has been renewed several times, though sometimes a little late and with new sponsors difficult to recruit. Sponsors are still enjoined as follows: "Begin your meetings with your protégés during the first trimester of the first year, when the need is most strongly felt. If meetings continue subsequently, so much the better!" For all intents and purposes, the sponsorship system has not succeeded in satisfying its initial objectives. Is it through lack of skill in fulfilling the role, which can not be played to order? Many students have said that their sponsors seem ill at ease. This is *the only activity that is not remunerated* (chapter 10).

#### *The course on interdisciplinarity*

The first course on the interdisciplinary approach began in September 1990. Students boycotted it, saying they already had enough material with problems in the multidisciplinary PBL unit (unit 14). Activities in the course were therefore suspended for two weeks and negotiations took place. The Curriculum Board displayed a firm will to keep the course in place, because it responded to new social needs and corresponded to current trends in medical education. Students came to accept it after having won changes to the conditions of assessment. Specifically, the requirement for a group written report was dropped. Those who at the very minimum carried out the activities would receive a passing grade. Those wishing to receive an A would have to sit an examination.

That year, the course took place somewhat haphazardly. Students' hearts were not in it. It would seem they suffered an acute competency crisis, no doubt prompted by the highly demanding problems studied during the unit. The objectives set regarding attitudes were probably not achieved, but this was not verified. Only half the students sat the exam. In spite of everything, the results of an evaluation questionnaire at the end of the trimester showed 40% of the students relatively satisfied with the course and feeling that they had mastered the objectives and acquired the attitudes in question.

Those responsible for the course resigned. A new committee submitted a revised version. During the transitional year, students were no longer working with their Nursing Science peers, and the problems devised for unit 14 were not modified. But it was possible for interdisciplinary activities to take place by being grafted onto clinical skills, thanks to the openness of the Geriatric Center. In 1991-92, a third committee introduced interdisciplinary components into the clinical immersion rotation, clinical skills, and the clerkship, and restructured activities in the course in third year.

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It remained to better integrate these activities into the program. Nevertheless, the interdisciplinary approach finally took root in the MD program in the form of a specific learning activity. The Curriculum Board did not let go of the idea of adding the interdisciplinary approach to the skills that must be acquired by future physicians. A longitudinal unit spread over the program's full four years has been "offered" since 1992; its role is to present integrative activities progressively.

To sum up, the clinical skills unit, the clinical immersion rotation, and the course in Ethics and Medical Law satisfied initial expectations. These activities lead students efficiently and reliably to acquire various levels of knowledge and attitude appropriate to medical humanism. On the other hand, PBL, the course on interdisciplinarity, and the sponsorship did not have the hoped-for impact on the humanistic dimension.

Nevertheless, twice the program for humanistic learning was presented to two humanistic philosopher-physicians: Jean Bernard in autumn 1989 and Edmund Pellegrino in autumn 1991. Both were agreeably surprised by the teaching methods centered on student participation. They recognized that our activities are integrated into other forms of teaching all through the preclinical phase, and that this must in the long run yield beneficial effects. In light of our discussions with these specialists, we came to realize that we are tackling the central challenges of the teaching of medical humanism and that we must increase the ethical component, which provides fertile soil for the building of cognitive knowledge about humanism.

## The Next Phase

The time seemed to have come to plan concerted and specific action designed to push humanistic learning still further. A project of this kind could not succeed without an unequivocal commitment by the leaders of the Faculty of Medicine. For this stage to succeed, we needed experts capable of designing instructional methods specifically adapted to the context of the new program. These teachers formed the *Comité de l'unité longitudinale de l'humanisme*, the Committee on the Longitudinal Unit on Humanism. The Committee is working on specific objectives grouped around the theme "The Acquisition of Humanism: A Patient-centered Process", with a view to formulating the Faculty of Medicine's official position on medical humanism. Its members are considering creating a humanistic teacher prize, maximizing the use of role models as a teaching tool, and developing a plan of action by the Faculty that will promote medical humanistic learning. In this perspective, the Committee is to study the following projects:

- the importance of the language used in promoting medical humanism;
- the role of admission criteria in students' potential for development;
- the feasibility of setting up programs for humanistic education for teachers;

- the opening up of administrative units, including professionals and support staff, to the humanistic project;
- the conversion of a cubicle in the library to a space dedicated to humanistic concerns, with documentation, old medical instruments, reproductions of paintings and portraits of celebrated humanistic physicians, a computer with a range of applications that develop humanistic culture, and so on;
- interest in occasional publication of collected texts on humanism by teachers and students;
- validation of the project as a whole through presentations at specialist colloquia;
- the preparation and dissemination of a list of books with a humanistic interest, and reading suggestions for students and teachers.

This project should come to be gradually integrated into the culture of the Faculty over the next few years. A committee has been set up to study the integration of the teaching of ethics into each level of education: MD program, graduate work, and continuing education. It is time to go forward. The success attained by the reform made it possible to introduce flexibility into traditional teaching. Clinical training settings at the levels of both MD and postgraduate studies, as well as the Center de formation continue, or Center for Continuing Education, are open to change. Soon the majority of our graduates will be competent, upright, compassionate young physicians who respect the values of their patients and of other medical personnel. Only a medical faculty could have risen to such an educational challenge.

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## Reforming the Clerkship: The Challenge of Clinical Learning

Bernard Charlin, Martine Chamberland and Jacques E. Des Marchais

*Education should allow individuals  
to discover things for themselves  
The best we can hope for from schools  
is that instill in students the love of knowledge  
and the desire to learn. If you do so, you have won  
If not, you have failed  
- Paraphrase of Noam Chomsky*

It was inevitable that sooner or later the wave of renewal in preclinical studies would reach and shake up the clinical phase, that is, the clerkship. A feeling of having run out of steam set in almost as soon as the production of Problem-based Learning units was completed. As well, in contrast to the preclinical PBL program, few models existed on which to base reform of undergraduate *clinical* education. In North America, for some 25 years now, preclinical curricula have been subjected to significant improvement; but clinical education programs (clerkships) have remained relatively traditional (Eichna, 1980). They constitute one of the most important challenges confronted by medical education, if the gains made during the preclinical phases are to be maintained and to benefit future practitioners.

The hospital departments that clinical teaching depends on are various and autonomous. Specialists in medical education have little influence over them. For Sherbrooke's Faculty of Medicine, the challenge was to introduce the guiding principles of our program reform and thus transform the clerkship into an educational experience more heavily centered on the student, the patient, and the needs of the community. The process of conception underlying the change gave rise to an innovative model.

How should we define the problem of clinical learning? What innovative concepts inspired the clerkship model devised at Sherbrooke? What difficulties are presented by the conception and implementation of such a model? What are the conditions for implementing a reform to the clerkship?

### *The problem of clinical learning*

Literature on clinical learning has brought to light some of the major problems associated with the clerkship (McLeod et al., 1985; Morgan, 1986; Irby, 1986; Ambrey, 1985; Mellikoff, 1987; Association of American Medical Colleges, 1984). These problems, which may be considered universal, are to be found to various degrees in our own setting.

They must be taken into account in the development of a framework for the clerkship. Here they are in summary form:

- The definition of *specific objectives* is often deficient if what we are seeking is realistic objectives linked to clinical activities, formulated in observable and measurable terms, and suited to guiding students towards whatever is educationally most profitable.
- The position occupied by students within the hospital's care pyramid is often one of a *passive observer* of discussion. Although the learning process is supposed to be based on the study of clinical problems, the student's clinical reasoning is not often asked for, highlighted, or assessed.
- It is not possible to anticipate what clinical cases a student will confront. Learning takes place *as chance dictates*, and this does not necessarily correspond to preset objectives.
- Too often, and especially within care units, the clerk only begins to take an active part once the clinical problem has been formulated and the course of action to be taken has been planned by consulting physicians in the outpatient clinic or the emergency room. Clerks are thus deprived of the opportunity to gather and analyze clues and confined to managing investigation and care.
- The patients a student encounters in a university hospital setting, especially in a tertiary-care institution, are seriously ill. Often they have been hospitalized for the purpose of supplementary investigations or intensive treatment. Patients of this kind, who present multiple and complex pathologies, do not offer ideal cases for students just embarking on their clinical education.
- The role of the clerk is ill-defined. In general, the service component of her role is overemphasized, to the detriment of her involvement in experiences that would benefit her educationally.

In the wake of the implementation of a PBL preclinical program, it is essential to reflect on the specific educational needs of the new student clientele. There is little on this subject in the scientific literature (Schmidt et al., 1987; Coles, 1985; Newble et al., 1986). And yet, consideration of the very foundations on which PBL is based (Barrows et al., 1980; Schmidt, 1983) would lead one to expect that PBL-educated students would be more active participants, state their ideas and discuss their positions, and raise questions and suggest hypotheses for solutions. They are students that are supposed to have better mastered how to make use of their knowledge with a problem-solving approach. Hence the importance of submitting problems to them and arranging for them to meet categories of patients who correspond better to their learning objectives. These students are supposed to have attained a self-sufficiency as learners that must continue to be furthered throughout the clerkship. A way must therefore be found to provide student-centered learning experiences even during the clinical phase.

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## An Innovative Model

What principles should guide the development of the clerkship program?

### *Principles for developing the clerkship program*

Maintaining consistency in the reform required that changes to the clerkship follow the main philosophical lines of the new program, namely that they be *centered on community needs and on the student and imbued with humanism*. The specific problem of clinical education led us to formulate some general principles that we viewed as essential in the reform of the clerkship:

- More specific and realistic learning objectives must be defined, to ensure the educational process is both systematic and realistic.
- Students must be presented with an increased number of primary-care situations to bring them closer to the real needs of the community.
- The proper balance must be struck between the clerk's educational needs and traditional service role.
- Educational activities must be put in place and promoted that treat the student as an active participant.
- The clerkship must continue the growth in the student's autonomy.
- Interactive learning activities that facilitate the development of clinical reasoning and the acquisition of knowledge about investigation and therapeutics must be devised.
- A way must be found to mitigate the unforeseeable and variable nature of clinical cases.
- Learning at the patient's bedside, based on the problems encountered, must be optimized.
- Methods of assessing learning that relate to the specific competencies to be acquired must be implemented.

### *Contents of the clerkship*

The clerkship's contents proper must naturally take account of two elements: the student's prior knowledge basis and the results expected at the end of the clerkship. At the start of the clerkship the student has just emerged from the PBL process, in which emphasis was placed on acquiring knowledge in the basic sciences and mastery of mechanisms that explain both normal and pathological phenomena in the body. Simultaneously, the student worked to acquire basic clinical skills relating essentially to healthy subjects, as well as certain technical maneuvers and communications skills.

At the end of the clerkship, when he obtains the MD, the student is called upon to choose among the very diverse disciplines comprised of family medicine, medical specialties, and surgical specialties. The clerkship is thus intended to provide a general education and equip the graduate with the prerequisites for undertaking study in any medical field. Since 1988, in Quebec, the period of postgraduate clinical education required to obtain a practitioner's license as a generalist in family medicine, which was formerly one year, has been two years

long. Thus it is only at the end of this supplementary period of clinical education that a student is expected to be ready to take on full responsibility for a patient.

The goal of the clerkship, therefore, is mastery of the major principles and mechanisms that underlie a medical procedure and the skills and attitudes related to this procedure, whereas learning every detail of the medical procedure itself, that is, mastering the ability to take responsibility for every detail of patient investigation and care, is properly a part of postgraduate studies in family medicine or the specialties (Faculty of Medicine, University of Sherbrooke, 1990).

The difference between the knowledge base the student has acquired at the start of the clerkship and the desired result for the end of it led us to identify the following specific contents:

- *Cognitively*, the clerkship must emphasize the development of clinical reasoning, problem-solving learning, and mastery of the principles of investigation and therapeutics.
- *In psychomotor terms*, students should perfect clinical skills already acquired, learn to apply them in pathological contexts, and continue learning a series of technical maneuvers.
- *As regards attitudes*, during the clerkship students should apply the concepts they have been introduced to about communications and humanism in the unit on clinical skills. In connection with these concepts, they should develop attitudes suitable to their new clinical responsibilities, their relationship with the care team, and the requirements of medical ethics.

## The Objectives

### *Realistic and clearly defined required objectives*

At the end of their clerkship all students should have mastered a certain number of clinical skills, whatever the order in which they did their rotations. These requirements constitute the *general required objectives*.

From the clerk's point of view, the essentials of clinical procedure, communications skills, and attitudes are common to all rotations. Only rotation contents change. It is thus possible to define common objectives in all disciplines as regards skills in reasoning, clinical procedure, communication, and attitudes. A review of these objectives led to the development of a list of general objectives (Table I). This preliminary stage makes it possible to focus better on objectives specific to each discipline later on.

Table I. General required objectives for all disciplines

At the end of each rotation, taking into account objectives defined within the discipline and the *most frequent etiologies*, the clerk should know how to explain the mechanisms and concepts involved and:

***Clinical reasoning and knowledge***

- gather initial clinical data (symptoms and signs) appropriately;
- arrive at an preliminary formulation of relevant hypotheses;
- proceed to gathering clinical data (history and clinical examination) in light of the hypotheses formulated;
- supplement data gathering with a system review and a general examination, with a goal of finding supplementary indices about the main problem and bringing associated conditions to light;
- discuss hypotheses in a structured manner in order to place them in a hierarchy;
- call for appropriate investigative tests, taking account of their predictive value, their potential danger, and their costs; and know the principles with which to interpret them;
- gather and interpret the results of the investigative tests;
- make diagnostic choices and justify them;
- present a presumptive or final diagnosis and justify it;
- define the principles of treatment;
- detect indications that the patient should be hospitalized or see a consultant when clinical circumstances require it;

***Communications***

- demonstrate good mastery of both oral and written presentation of medical observations;
- make effective use of computer systems in maintaining medical charts and managing care, in hospitals where chart management is computerized;
- establish good communications with the patient and the family if necessary and appropriate;
- participate in the patient's and the patient's family's health education, if necessary and appropriate;
- identify, locate, consult, and critique available references and resources.

***Attitudes***

During the clerkship the student should:

- become a full member of the care team and learn to work with the different types of health professionals;
- acquire the mastery and self-confidence necessary to perform medical procedures;
- demonstrate the ability to organize her clinical work appropriately;
- demonstrate attitudes related to organic, functional, and socioeconomic issues that are appropriate to taking responsibility for a patient;
- acquire the ability to respond appropriately and rapidly to an emergency;
- display tact and respect for patients and an ability to win their confidence and cooperation while soothing their anxieties;
- be able to discuss methods of treatment and expected results with patients and their families;
- show sustained interest at meetings and scientific events and when participating in discussions and group work;
- abide by the code of medical ethics by displaying honesty, altruism, and dedication.

Having arrived at the next stage, we drew up two lists for each discipline: one for *clinical problems*, for which students would be required to demonstrate a knowledge base and clinical reasoning ability; the other for *pathological entities*, for which students would again be required to acquire knowledge and general understanding of the diagnostic and therapeutic principles. The number of clinical problems per discipline depended on the number of clinical-reasoning learning sessions organized around it during the rotation. The number of pathological entities depended on what was viewed as a realistic workload, taking rotation length into account. Thus the five regular clerkship rotations entailed 265 required objectives and 67 clinical problems are studied systematically in small groups (Table II).

Table II. Number of required objectives per discipline\*

Discipline	Clinical problems	Pathological entities	TOTAL
Surgery	14	45	59
Medicine	19	42	61
Obstetrics-gynecology	13	47	60
Pediatrics	14	43	57
Psychiatry	7	21	28
<b>TOTAL</b>	<b>67</b>	<b>198</b>	<b>265</b>

\* Clerk Handbook, 1991-1992

Generally, a regular rotation lasts seven weeks and only allows for achievement of a limited number of required objectives. Each discipline therefore worked to identify a reasonable number of objectives, on the understanding that students will have at least two years of postgraduate education before obtaining their license to practice independently. This means that it is not necessary to be exhaustive; rather, it makes sense to concentrate on the essentials.

*Situational objectives*

Henceforward, clinical activities were to be the most important for the acquisition of knowledge, skills, and attitudes during the clerkship. Learning was now centered not on books but on the patient. The clerk must profit from all occasions to learn from the patients she is taking care of, even if the clinical problems and pathological entities they present do not correspond to the required objectives. Thus a package of clinical competencies and knowledge constituting *situational objectives* were added to the core of basic common skills and knowledge. The situational objectives depend on the order of the rotations, patients encountered during clinical activities, and a student’s individual interests. Being

subject by definition to variation, they call upon students' capacity for autonomy and self-directed learning.

### *Clinical-reasoning learning sessions*

To facilitate achievement of the required objectives, the clerkship program made recourse to a new educational activity: *clinical-reasoning learning (CRL) sessions*. These sessions are built into each regular rotation (medicine, surgery, pediatrics, psychiatry, and obstetrics-gynecology). CRL sessions are aimed essentially at the achievement of cognitive objectives:

- They facilitate the development of clinical reasoning applied to the required problems.
- They promote the acquisition of knowledge about investigation and therapeutics for the required pathological entities.
- They mitigate the inability to plan for clinical cases by offering students the possibility of encountering required problems and some of the required pathological entities even when they do not have patients presenting with them in the care unit.

This activity is inspired by the model for iterative hypothesis testing in clinical reasoning, which is characterized by an preliminary formulation of hypotheses and their iterative evaluation in the process of investigation (Barrows et al., 1980; Elstein et al., 1978). During CRL sessions, the sequence of events of a clinical meeting is simulated: the physician formulates hypotheses based on information provided by the patient; then, using an investigative strategy for which these hypotheses provide the direction, he reconstitutes all the data of the problem; and last, he reevaluates his hypotheses in light of the data gathered.

To reach this stage, we use an adaptation of the method described by Kassirer (Kassirer, 1983). A small group seeks to solve a given problem. One member of the group has evaluated the patient ahead of time or familiarized herself with one of the cases in the bank and knows all the data. This student plays the role of *data repository and provider*, and therefore does not make the usual case presentation. She does not reveal the data unless explicitly asked to do so by other members of the group. Students can ask any question whatever about the case or the physical examination that may yield supplementary data. Nonetheless, every question must be justified: What hypothesis has the student got in mind? Why has the student posed this question? The *data provider* provides the answer; the student who posed the question must now interpret the information obtained. Does the information modify the hypothesis? Does it lead to a better articulation of the diagnosis? Are other hypotheses possible?

This method enables students to reconstruct the clinical case so that the critical intermediate steps in clinical reasoning are thrown into relief. This activity thus becomes an *interactive voiced simulation of problem solving*. At the end of the discussion students must provide a general synthesis of the approach to the problem and of the principles of investigation and therapeutics of the pathological entity illustrated by the particular case. The session concludes with the group's assessment of the activity and each member's setting learning objectives to be achieved later on (Table III).

Table III. Steps in CRL

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1. The student acting as *data repository* states the reason for the consultation.
  2. The group reconstructs the clinical data using the Kassirer method and the intermediate stages of clinical reasoning, voice aloud.
  3. The *data repository* reveals the data that were not provided in stage 2.
  4. The group formulates the problem and produces a succinct statement of the key elements in the clinical data, in non-diagnostic terms.
  5. The group evaluates the preliminary hypotheses and formulates an appropriate differential diagnosis.
  6. The group develops an investigation plan.
  7. The group reevaluates the hypotheses chosen in stage 5 and chooses the final diagnosis.
  8. The group develops a treatment plan.
  9. The group arrives at a synthesis:
    - of the general approach to the problem discussed;
    - of the principles of investigation and therapeutics of the pathological entity discussed.
  10. The group conducts an assessment of the activity.
  11. Each member draws up his or her own personal learning objectives.
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As a matter of practice, all the required problems are discussed during these sessions. The program provides for two sessions to take place per week, each one lasting around one hour. The small groups consist of from three to seven students, each of whom takes a turn playing the role of *data provider*, *first interviewer*, and *secretary*. The secretary's role is to summarize on the board the key steps the group carries out as they take place. A clinician-teacher in the discipline concerned acts as group leader and guides the progress towards clinical reasoning specific to each discipline. This teacher takes control of the stages of CRL.

### *Learning centered on community needs*

Three rotations have been added to those of the traditional clerkship: community health, family medicine, and primary acute care. They are intended to enable students to better grasp the health needs of their society, take a holistic approach to patients that considers their physical and psychosocial characteristics, and master the principles of preventive, corrective, and rehabilitative care. To this end, the clerkship has been extended by three months, and now lasts eighteen months, from January of third year to June of fourth year.

### *The community health rotation*

There are two components to the community health rotation. The first is intended to enable students to acquire the theoretical knowledge indispensable to any community health

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action, specifically the principles of intervention, the stages of its planning, the roles of different interveners and institutions in the health system, and the guiding principles of Ministry policy. The other component allows the student to carry out an activity in the field with representatives of the community. The activity must be useful and meet community health needs existing at the time of the rotation. It varies as these needs evolve.

In 1990, this rotation was aligned with a Ministry requirement calling for responses to the document *Improving Health and Well-being in Quebec*. Pairs of students were integrated into the teams conducting the consultation process. They were required to gather interveners' reactions in each municipality of a given health district. Their task consisted of planning and carrying out the consultations and drawing up a report under the guidance of those responsible for community health. These data were used in the formulation of the district's official response to the Ministry.

In 1991 and 1992, students in teams of three or four carried an appropriate prevention project for the primary care or community organization to which they were assigned for their rotation. These projects were supervised by a community health professional whose educational background was not in medicine. Each year, twenty-four such projects are carried out. They relate to prevention issues in the following fields: cardiovascular health, autonomy of the elderly, mental health, perinatality, support to parents, drug addiction, and sexual health.

#### *The family medicine and primary acute care rotations*

Students do their family medicine rotation with a general practitioner in a setting that promotes holistic and continuous health care. In this way, the rotation provides the student with contact with the pathologies and problems most often encountered in primary medicine.

The student works specifically with the organic, psychological, and social aspects of patients' problems and on ways that family and community can help the patient understand them and resolve them. In meetings with patients, emphasis is placed on strategies for incorporating preventive measures. The aim is for the student to observe and experience the role of the family physician within the health care system.

Pairs of students follow physicians who practice as a group. There are weekly teaching activities based on self-directed learning and meetings with teacher-practitioners. Themes chosen beforehand and related to specific objectives deal with different aspects of primary practice: preventive medicine (hypertension), childhood and chronic diseases (asthma), workplace accidents (low back pain), geriatrics (depression in the elderly), and the therapeutics for the most common ailments (antitussive medications, antibiotics, analgesics, etc.).

A rotation in primary acute care lasting the same amount of time as the family medicine rotation is interwoven with activities in family medicine over the course of the week. Additionally, the activities carried out alongside general practitioners all take place in an acute care setting, whether an emergency room or a primary care clinic, so that the clerk encounters the constraints of primary care and walk-in consultation.

### *Student-centered learning*

The role of the clerk comprises a clinical service component and an instructional component. The clinical service component consists of assuming responsibility, as a member of a care team, for a range of tasks in patient care that is decided upon in each department. The clerk's responsibilities are:

- writing up case histories and conducting physical examinations for patients admitted;
- recording notes on the progress of the case, keeping them slanted towards the patient's problem and its solution;
- under supervision, submitting an investigation and treatment plan;
- writing up the summary sheet;
- participating in outpatient activities;
- presenting cases and participating in seminars, reading clubs, and scientific meetings.

The instructional element requires the student to systematically set aside time to continue the learning process.

### *Reserved study time*

A clerk is first and foremost a student receiving a clinical education, and has specific educational needs. It is essential that he or she acquires the habit of consulting reference books and articles when faced with a clinical problem. To do so, she must dedicate time systematically to this during regular working hours. For every rotation, therefore, 15% to 20% of working hours a week (approximately 6 to 8 hours) must be reserved to allow the clerk to meet her learning needs in respect to investigation, follow-up, and resolution of clinical problems.

This reserved time, which is necessary but must be managed flexibly, is subordinate to and incorporated into clinical activities. After all, it would be unreasonable to walk out of a potentially educational clinical activity to go to the library. Nevertheless, reserving time for self-directed learning entails a change of attitude among teachers and residents. Accepting the concept means recognizing that the clerk has educational needs that go beyond providing clinical service and must be given the time to study those cases in connection with which she feels the need for deeper knowledge.

### *Changing the attitudes and role of the teacher*

The new model clerkship and the adult-education principles that underlie it presuppose

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changes in the role of teacher, just as reform to the preclinical phase did. The teacher ceases being a vessel of knowledge, becoming instead an instigator of clinical reasoning, a stimulus for student motivation, and a source of continuous assessment.

Under the new model, the teacher is called upon to analyze student performance and, above all, diagnose a student's strengths and weaknesses with a view to suggesting corrective exercises. Medical educators often give students no more than evaluative feedback: "That's fine; keep that up", or "That won't do at all; you have to improve". But to be an effective teaching tool, feedback must be descriptive rather than evaluative (Ende, 1983). It must be early, iterative, analytic, and encouraging.

Finally, enabling clerks to reserve time for reading (reserved study time) will only be effective if the teacher prompts the student to use the time and asks occasional questions on recent learning. This role entails that professors change their attitudes and acquire new skills; it therefore means planning activities for upgrading teaching skills.

### *Patient-centered learning*

When students emerge from PBL and are about to embark on their clerkship, they are a bit weary of paper problems and eager to encounter flesh-and-blood patients with real problems that they can help solve. The context of learning now comes closer and closer to the work of the physician that every student aspires to do. Learning during this stage gives rise to a high level of stimulation that ought to bear fruit. To yield maximum benefits, clinical education should be centered on the patient: the pre-eminent source of information, human experiences, and acquisition of competency.

Through problem-based learning, the student will have learned to organize the knowledge in his memory on the basis of a clinical problem rather than classifications and lists of diseases. Transferring this procedure to the clerkship should occur naturally. It is in this context that contact with the patient assumes its full importance, for it triggers the diagnostic procedure and prompts the solving of a clinical problem. Through reserved study time the student is invited, not to say strongly urged, to deepen his understanding of the problems presented by the patients he meets and whose condition he evaluates during clinical sessions.

The significance of the *clinical problem* as a stimulus to clinical-reasoning learning is reinforced by the setting of required objectives for each rotation and the list of priority problems and most frequent pathological conditions.

The acquisition of clinical skills during the preclinical phase included the important component of *Communication-humanism*. Through the sessions dedicated to this theme, distributed over two years, students are enabled to discuss and sometimes even experience various aspects of the helping relation. In the clinical phase, at the patient's bedside, they can benefit from the richness of the physician-patient relationship and apply the humanistic knowledge they have acquired.

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### *Student assessment*

The definition of new objectives and the adoption of new learning methods, in particular the CRL sessions, made it necessary to update the process of formative and summative student assessment. The exercise we conducted was aimed to better measure different types of competency while still taking into account the classic trinity of *validity-reliability-feasibility*.

There are two parts to *formative assessment*. Midway through each rotation, a student meets with the teacher-clinician responsible. Criteria mapped on a summative assessment grid guide the discussion. What needs to be found is effective strategies for motivating teacher-clinicians to devote time to this assessment, beyond what they do informally or in special cases. The second component consists of a written exam taken by the whole class four or five months before the clerkship ends. Designed on the model of the Qualifying Examination, this exam enables students to check how far they have come in relation to the final expected achievement level.

*Summative assessment* methods and their weighting for the attainment of the MD have been modified. These changes were aimed at reducing the importance of taxonomically low cognitive objectives (memory only) and increasing the importance of higher level objectives (problem analysis and solving) as well as assigning greater room to psychomotor and attitudinal objectives (Table IV). The summative assessment for the clerkship makes use of four methods: assessment grids, objective structured clinical examinations (OSCEs), structured oral examinations, and the Medical Council of Canada's Qualifying Examination, Part I.

The *assessment grid* was revised to adapt its different components to new dimensions of the clerkship, specifically clinical reasoning, clinical problem solving, clinical and technical skills, autonomy, communication, and medical ethics. Compiling the grades obtained in each rotation yields a comprehensive grade that represents 35% of the final grade for promotion from the clerkship.

Another 35% is assigned to specific assessment of clinical and technical skills (measured in each station by an OSCE) and assessment of clinical reasoning (conducted by means of a *structured oral examination*). In this way, discipline-specific skills are measured at the end of rotations in the five major regular disciplines (medicine, surgery, pediatrics, psychiatry, obstetrics-gynecology).

The Medical Council of Canada's Qualifying Examination accounts for the final 30%. This is a written examination common to all 16 Canadian faculties of medicine, consisting of 540 multiple-choice questions that measure a student's general knowledge at the end of the clerkship. In a survey conducted with the first cohort to take the exam, which had a response rate of 90%, students said that the majority of questions (70%) tested memorization only.

Table IV. Fit between objectives, activities, and assessment

Objective	Learning activities	Assessment methods
Knowledge	Individual study Care team	Written tests (Qualifying Examination) Assessment grid
Clinical reasoning Problem solving	CRL sessions Care team	Assessment grid Structured oral examination OSCE*
Psychomotor skills	Care team	Assessment grid OSCE*
Autonomy	Log book Care team Care team	Assessment grid  Assessment grid OSCE
Communication Humanism Service to patients	Care team	Assessment grid

\* OSCE: objective structured clinical examination

Implementing a New Teaching Model for the Clerkship and Forming the Clerkship Task Force

In April 1988, a year and a half before the first cohort in the new MD program was to begin its clerkship, the Faculty of Medicine’s vice-dean education assigned the clerkship coordinator, Bernard Charlin, the task of carrying through the teaching reform such that it could be implemented within the clerkship. Faced with the task of designing a reform to a sector in which it is notoriously difficult to innovate, the coordinator expressed surprise and anxiety.

To improve the reform’s chances of success, a task force headed up by the coordinator called upon innovators in teaching and opinion leaders from various clinical departments. It was felt such a mix would lead to suggestions for change and allow for their being progressively tested for feasibility within departments. This work lasted a year and a half, entailing an obligatory two-hour meeting every two weeks.

The task force’s worked progressed in spite of the usual difficulties. Spells of intense productivity were succeeded by periods where work was blocked by sometimes minor issues. Members were not always regular in their attendance and participation. This difficulty was circumvented when a principle was established whereby members were

presumed to have endorsed the decisions made. The nature and feasibility of certain educational activities, including CRL sessions, were the subject of prolonged discussion. Criticism of the new requirements was acerbic, and yet in spite of everything, as the months went by, the main principles of the reform emerged. The project took shape because it was regularly subjected to the crucible of feasibility, a criterion of understandable importance to a task force consisting of clinicians.

In February 1990, the task force submitted a well-knit program to teachers in a thirty-page document presenting the problem the reform was tackling, the new teaching methods recommended, and the proposed calendar for implementation (Faculty of Medicine, University of Sherbrooke, 1990)).

### *Educating teaching resources in an institutional context*

Success in innovating in an educational setting that includes numerous hospital departments, several hospitals, local community health centers, specialists in many disciplines, and family physicians scattered over a large territory presupposes a culture of receptivity to change, a critical mass of professors with an education in teaching methods, and educational resources to prepare the other teachers. Just as it did for the preclinical curriculum (Chapter 8), the Faculty of Medicine rendered reform of the clerkship possible by offering a preparatory education in teaching skills to the corps of teaching personnel. This program was spread out over several years and continues to offer upgrading seminars in medical education. It is an indispensable condition for any significant change in teaching methods.

Working with a group of teachers of great good will also certainly constitute an indispensable condition; but more is needed. A system of education that is consistent in all its parts must be built: the evaluation of teachers' educational needs, the determination of objectives, the creation of suitable educational activities, appropriate assessment of participants, and set-up of ongoing procedures for improvement to the system. All this presupposes the availability of a certain number of educational resource persons. There must be verification of alignment between the concepts chosen and progress made in medical education. Solutions to problems similar to those being solved must be sought in the scholarly literature. Sufficient educational competency to ensure that clinical and preclinical innovations are in step with one another must also be available. Academic clinicians may be accustomed to conducting this kind of research in their own discipline but do not necessarily have experience of such research in education. Most of them, stretched thin between their activities as physicians and teachers, have neither the time nor the energy to carry out this enormous task.

The role of expert consultants in education was assumed by those responsible for the reform, the vice-dean education and the director of the MD program, and by a teacher, Martine Chamberland. The latter had specific training in medical education and contributed to the development of the principles for the new clerkship by designing the formula for the

CRL sessions. Sherbrooke's experience proves that it is very useful for such resource persons not to be educational experts only, but also clinicians whose competence is recognized in their milieu. This constitutes a condition necessary to the reform's credibility.

One of the main obstacles to improvement in clerkship programs in North America is the autonomy and diversity of the hospital departments in which this educational process unfolds. Innovation of any kind must rely on the good will and the openness to change of those who run these departments. The urgency of the need to deliver clinical services, however, often results in consigning clerks' educational needs to the sidelines. At Sherbrooke, the way professional practice is organized under the Société des médecins (See Chapter 10) and clinicians' close relationship with the Faculty of Medicine may have made for conditions more favorable to our reform. As well, it is indispensable for a faculty of medicine to enjoy a degree of authority with hospital departments.

### *Changing the rotation grid*

To increase student involvement in primary care and bring students closer to the true needs of the community, the Curriculum Framework Committee decided to prolong the clerkship by three months and include three new rotations: community health, family medicine, and primary acute care. This change gave rise to a prolonged deadlock in the operations of the clerkship task force. It is well known that during a process of educational change, distribution of time allotted to various disciplines entails a change in the power structure (Barrows et al., 1984). Opening up the traditional grid allows for disciplines that have long laid claim to an extension in the training period they are assigned to restate their demand with increased vigor.

The new distribution of time changed the number of weeks assigned to each discipline, which resulted in variation in the number of teaching activity units assigned to departmental accounts (See Chapter 10). Prolonging the clerkship beyond a year also created a problem of overlap between two cohorts.

These requirements, which many saw as conflicting, resulted in weeks of discussion. To break the deadlock, the vice-dean gave a special committee the mandate to listen to the various points of view and put a definitive choice to the dean's Office. This approach aroused some resentment, but did resolve the situation. The new distribution (Table V) avoided overlap, allowed for rotations in the community, and preserved an appropriate length of rotation for each discipline, according to the average obtaining in North American medical schools.

The clerkship program is spread out over 74 weeks and includes the five usual rotations in surgery, pediatrics, psychiatry, obstetrics-gynecology, and medicine. Each of these except the medicine rotation lasts seven weeks; medicine is ten and a half. Thus the program currently assigns 38.5 weeks to traditional subject matter. The time for elective rotations has been reduced to twelve weeks. The three new rotations: community health

(four weeks), family medicine and primary acute care (seven weeks), and one multidisciplinary rotation three and a half weeks long, have prolonged the clerkship by 14.5 weeks. Three weeks of vacation and six weeks to prepare to sit the national examinations (See Table V) must be added to the 65 weeks of clerkship.

### *Changing the objectives*

The clerkship under the old curriculum had detailed educational objectives, but these were unattainable given the length of the rotation objectives. Moreover, student assessment was not based on rotations. Revision of clerkship objectives was designed to correct these failings, while motivating students to work on the basis of cases encountered during clinical activity and thus ensuring consistency between learning activities and objectives.

In arriving at the lists of required problems and pathological entities, recourse was had to several available sources such as data banks produced by certain universities and professional organizations (McMaster, Ottawa, Medical Council of Canada, etc.). The objectives were set following a process that took a whole set of factors into account: the prevalence of diseases and health problems, their duration, their urgency and gravity, the frequency of medical consultations they give rise to, and the effectiveness of the diagnostic, therapeutic, or preventive procedure. It is interesting to note that these in-depth verification procedures resulted in relatively different lists of objectives.

At this point we decided to use both lists drawn up by other institutions and our own old lists. The final choice of objectives was made by consulting teachers in each discipline and taking account of our own community's needs. The lists thus arrived at were submitted to the clerkship task force for fresh validation, with the goal of avoiding duplication and determining whether the new objectives for each rotation were realistic and attainable (Table VI).

Since these objectives are for the use of both students and teachers, it is essential that a process of assessment verify whether they have been reached. The rotation observation checklist provides a longitudinal measurement of very diverse competencies, but does so at a different level; it only partly measures the attainment of required objectives. The provincial comprehensive examination is not designed exclusively for our Faculty of Medicine. A structured oral examination and OSCEs were added to enhance the monitoring of the attainment of objectives while emphasizing effective use of the required problems.

### *Implementing the change*

Having an innovative project at your disposal does not suffice to ensure its implementation will be accepted, even when it has been designed by a committee that is representative of its setting. The project must be submitted to Faculty and hospital decision-making authorities, with an explanation of its goals and a justification for the methods it recommends. It is necessary to inform, convince, and sometimes reassure as many teachers

as possible by showing them that, among other things, the project will benefit the community and, in particular, will educate better candidates for residency programs.

Table V. Clerkship rotation grid

<u>January to March</u>	
Community health	4 weeks
Elective rotation 1	4 weeks
Elective rotation 2	4 weeks
<u>April to March of the following year</u>	
Internal medicine	3 1/2 weeks
Multidisciplinary rotation*	3 1/2 weeks
Family medicine and primary acute care	7 weeks
July vacation	1 week
General surgery	7 weeks
Pediatrics	7 weeks
Obstetrics-gynecology	7 weeks
Specialized medicine	7 weeks
Christmas holidays	2 weeks
Psychiatry	7 weeks
<u>April 1 to May 12</u>	
Preparation for and writing of national examinations	6 weeks
<u>May 13 to June 7</u>	
Elective rotation 3	4 weeks
<b>TOTAL</b>	<b>74 weeks</b>

\*Multidisciplinary rotation: ORL, ophthalmology, dermatology, anesthesia

Once the planning stage had been completed, a little Faculty party was held to celebrate the launch of the new clerkship program. Since our institutional needs had changed, we had to recruit people to take charge of rapid and effective implementation of the new clerkship and see to its daily management for each discipline. To accomplish this, a new committee was set up, composed exclusively of representatives from the different disciplines: the *Clerkship Coordination Committee*.

Each of the people recruited agreed to convince members of his own or her own department to organize the educational activities needed for the new clerkship. They encountered difficulty to varying degrees, depending on the openness of the different clinical departments. Constant effort by each one, however, saw that the structures were progressively put into place. The first cohort of students in the new program was received in the clinical departments in January 1990!

Poor cohort of 1987 to 1991! At each new stage, they were the guinea pigs for brand new teaching methods, administrative structures, and assessment procedures! With their demands, their critical sense, and their enthusiastic support, they became an invaluable asset in the implementation of the educational reform, in both the preclinical and the clinical phases. The Faculty of Medicine owes them a great deal.

Some activities were harder to win acceptance for than others: reserved study times, CRL sessions, and the new assessment methods.

The *concept of reserved study time* presupposes a new way for both teachers and residents to view clerks. In many hospital departments there has been hypertrophy of their service role at the expense of their educational requirements. It is often forgotten that clerks are above all students, with real learning needs that cannot be fully met exclusively through service to patients.

If we want clerks to develop the habit of consulting reference works when faced with clinical problems, they must be allowed the time to do so during the day. They already have work to do at night to attain the required objectives of their clerkship. Learning takes time. Winning acceptance within clinical departments for this reasoning was not easy, especially in cases where hospital work was heavy and the number of clerks limited. We opted for a strategy of gentle, progressive adaptation of clinical settings. The new concepts made their way, following recurring efforts at sensitization, facilitated by distribution of clerks that took account of clinical workload. After one year, reserved study time had taken solid root in obstetrics-gynecology, psychiatry, family medicine, and, to a lesser extent, pediatrics. Much needed to be done to reach this goal in certain medical and surgery departments.

Table VI. Clinical problems and pathological entities as rotation objectives in medicine

<b>1. CLINICAL PROBLEMS</b>	
1. Chest pain	12. Hyper- and hypo-: natremia, kalemia, and calcemia
2. Dyspnea	13. Dehydration; hypervolemia
3. Coughing	14. Acid-base disturbances
4. Hemoptysis	15. Regurgitation
5. Syncope	16. Peptic ulcer and complications
6. Shock	17. Cirrhosis and complications
7. Headache	18. Acute hepatitis; chronic hepatitis
8. Asthenia	19. Crohn's disease; ulcerative colitis
9. Coma	20. Ischemic and lacunar cerebrovascular disease
10. Confusion	21. Epilepsy
11. Lower limb edema	22. Migraines; tension headaches
12. Melena	23. Peripheral neuropathies
13. Hypertension	24. Multiple sclerosis
14. Acute and chronic diarrhea	25. Dementia
15. Fever - shivering	26. Rheumatoid arthritis
16. Acute renal insufficiency	27. Gout
17. Weight loss	28. Osteoporosis - osteoarthritis
18. Monoarthritis	29. Acute and chronic infectious pulmonary diseases
<b>2. PATHOLOGICAL ENTITIES</b>	
1. Atherosclerotic coronary heart disease	30. Acute pyelonephritis
2. Hypertension	31. Urethritis
3. Cardiac insufficiency	32. AIDS
4. Mitral and aortic valve disease	33. Acute bacterial meningitis
5. Cardiac arrhythmia and conduction disturbance	34. Bacteremia
6. Obstructive respiratory syndromes	35. Anemias
7. Interstitial lung disorders; pleural effusion	36. Blood transfusions and complications
8. Deep venous thrombosis; pulmonary embolism	37. Lymphomas
9. Acute renal insufficiency	38. Lung tumors
10. Chronic renal insufficiency	39. Prostate tumor
11. Glomerular diseases	40. Diabetes mellitus
	41. Hypo- and hyperthyroidism
	42. Hyperlipidemia

The *clinical-reasoning learning (CRL) sessions*, which constituted a new type of educational activity, were first tried out with a small group of students in medicine and obstetrics-gynecology with the goal of working out the optimal method for subsequent implementation in all regular clerkships. This operation called for no small investment of time on the part of those responsible for the reform within each discipline, in particular to recruit and train CRL facilitators and to develop a bank of written clinical cases illustrating each of the required problems.

Two main difficulties emerged in implementing CRL sessions. How could we establish a timetable in disciplines in which students were sometimes scattered in several subspecialties (medicine and surgery) and, in fact, different hospitals? The timetable needed to allow realistically for the assembling of clerks without imperiling existing activities within different clinical departments. The other difficulty lay in the uniform application of the stages in the CRL method, because of the large number of participating monitors.

Two observations could be made after two years' work with the CRL method:

- In general, the different steps were being well followed. The blackboard was being used, but to varying degrees, to record the salient points of the discussion and facilitate the systematic reevaluation of hypotheses: this needed reinforcement. Stage 9 -the synthesis- was generally being led by the facilitator, who summarized the discussion interactively and thus facilitated the organization of knowledge and its eventual transfer to other clinical situations.
- The roles of *data provider*, *first interviewer*, and *secretary* were being taken by students, except in psychiatry, where the clinician facilitator him-/herself played the role of patient in order to add the emotional, non-verbal content essential to the process of clinical reasoning.
- In general, the clinical cases used during these sessions were being taken directly from the banks devised for each discipline. Thus the same problems were being used with each new group of students. Since the emphasis is on the clinical reasoning process and not the final diagnosis, this repeated use in no way diminished the richness of discussion.

In contrast, efforts to *modify and enrich the assessment process* encountered dual resistance. Our teacher-clinicians were reluctant, at least until 1995, to add to their already considerable workload. The justification for the extra work required to conduct this assessment was not obvious to all. Moreover, students themselves experienced every change to the assessment procedure as threatening, even when aware that the new methods yielded a more reliable measurement of the knowledge, skills, and attitudes they needed to master. The introduction of OSCEs provoked a serious opposition movement; it was claimed it was largely caused by a failure to communicate (and yet students were faithfully represented at Clerkship Committee meetings). The coordinator and those responsible in different disciplines thus had to carry out a long process of sensitization and persuasion; they benefited from the help of members of the Clerkship Evaluation Committee, which lent them a hand within each department.

Naturally the question of *evaluating the program* also arose. Regularly and repeatedly administering an evaluation questionnaire and getting an acceptable response rate is not something that can be taken for granted. The evaluation instrument comprises 59 questions; it takes time to fill it out. Students understood that this time "donated to the Faculty" contributed to improving rotations but it was the cohort after them that benefited. A mechanism for compelling cooperation was therefore put in place: students do not receive their assessment for the next rotation until they have turned in the evaluation questionnaire. The work of compiling the results necessitated supplementary funds. To preserve anonymity, a tacit agreement with students was reached: evaluation results were not communicated before several evaluations had been compiled. The information passed on to those concerned contained an evaluation of the quality of rotations. This process of the Faculty of Medicine's reviewing the quality of work carried out and the

quality of education received placed the reputation of certain clinical departments in doubt, but our traditions of educational commitment and the habits acquired by students in the new program of evaluating every activity nevertheless enabled us to carry out the evaluation of the clerkship program.

In June 1995, the clerkship evaluation yielded this profile:

- Required educational objectives had been devised, and most students were referring to them. However, teachers' knowledge of these objectives needed deepening and their use must be promoted.
- Clinical-reasoning learning sessions were a success. Both students and teachers, who attended the semi-weekly activity faithfully, liked the formula. Teachers found the activity was not demanding of teaching time and resembled the clinical teaching procedure they were familiar with. Students, too, found that CRL session offered a major benefit. During their regular clerkship rotations they have more than 70 opportunities to reason aloud about typical clinical problems and the required objectives for different disciplines in the presence of experts in the field, who help them fine-tune their medical problem-solving skills.
- Student opinion was divided about the first community health rotations, which took place in 1991. Some enjoyed them very much; others found they were just used as "survey workers" without benefiting educationally. Corrective measures were taken in 1991 and 1992 to enable students to carry out projects that were both relevant and useful to the community but also introduced them to the principles of this form of action.
- The family medicine and primary acute care rotations were working well and satisfying their objectives. Since most take place in remote areas, they allow students to become familiar with a medical practice that is very different from the "hi-tech" medicine they have encountered in their other rotations, and better observe population needs.
- The notion of reserved study time was being well respected in most rotations, but not at all in some, specifically those where clinical workload is generally heavy. It was obvious from the start that this part of the reform would be the hardest to implement. The situation was nevertheless gradually improving, thanks to greater sensitization of students and teachers.
- Use of OSCEs for summative assessment, which had first been poorly received by students, was now accepted. The effectiveness of this method of assessment was beyond dispute because it led students to master rotation objectives on both a cognitive and a psychomotor level.
- The system of ongoing program evaluation by means of a satisfaction questionnaire was working. Transmission of the results to those responsible for rotations was not yet up to par, however. Use was therefore made of a computer program to produce graphs giving data on the performance of each rotation setting in relation to the average.

## Conclusion

Sherbrooke's reform of the clerkship allowed for the introduction of a certain number of new concepts and innovative methods into clinical education (Chamberland et al., 1992). To name just some, there was the redefinition of the contents of the clerkship; the setting of realistic and attainable learning objectives in relation to clinical problems and pathological entities; the addition of three months of community-based rotations; the introduction of reserved study time in clinical departments; implementation of a new activity for clinical reasoning learning (the CRL sessions); adaptation of assessment methods to the objectives (including measurement of skills and clinical reasoning); and, last, the setting up of a system of continuous clerkship-program improvement by means of an evaluation questionnaire that students fill in periodically.

These concepts and methods were introduced gradually during the first implementation year. We opted for a strategy of gradual adjustment by clinical departments to the new educational requirements. These new requirements, after all, entailed profound attitude changes by teachers, in clinical departments where the demand for care is constant and inflexible 365 days a year. An MD program *centered on the student* and on the *needs of the community* requires that the phase of clinical education be consistent with reform to the preclinical phase.

In light of this recent experience at Sherbrooke, it can be stated that the presence of a certain number of conditions is useful, not to say indispensable, if the bastion of educational traditionalism represented by clinical teaching in the clerkship is to have its foundations shaken. These conditions include a force within the medical faculty that supports the desire for innovation and can incite all the clinical departments to apply the reform; cooperation by teaching staff who are appropriately motivated, persuaded of the need for reform, and equipped with teaching techniques that will help them change their clinical teaching habits; work by a group of professors interested in researching the best methods to improve the clerkship and in implementing them; support by a network of people who take on responsibility for the reform within their own departments; and finally, work by a core group of people who undertake to dedicate time and energy to coordinating a reform calling for months of meetings, discussions, and pleading to get tangible and uniform results.

This is the price that must be paid to carry out an institutional change that will allow students who have reached the stage of clinical education to make the most of their preclinical PBL training and master clinical medical science; in particular, clinical reasoning and quality physician-patient relations, which is essential to the practice of medicine.

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Summary table. Innovative features of the clerkship

### INNOVATIVE FEATURES OF THE CLERKSHIP

1. Definition of *required specific objectives* in relation to the most commonly occurring clinical problems and pathological entities.
2. Implementation of a structured educational activity used in all regular rotations, *clinical-reasoning learning (CRL) sessions*. These are generally held twice a week and their goals are to:
  - promote the learning of clinical reasoning, investigation, and therapeutics;
  - mitigate the inability to plan for clinical cases;
  - continue fostering the growth of autonomy.
3. Learning centered on community needs through the addition of *required community-based rotations* lasting four weeks each in:
  - community health;
  - family medicine;
  - primary acute care.
4. Student-centered learning:  
the notion of self-directed learning and reserved study time;  
a change in teachers' attitudes and roles.
5. Patient-centered learning:
  - emphasis on clinical problems as a stimulus to learning in CRL sessions;
  - required objectives in the form of clinical problems;
  - situational objectives/patient problems encountered in care units;
  - use of reserved study time during service to patients.
6. Modification of the system of summative student assessment through the introduction of *objective structured clinical examinations* following each regular rotation.
7. Setting up of a continuous system for evaluating and improving the clerkship program through the administration of a *rotation evaluation questionnaire* that each student must fill in after every rotation.

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## PART THREE: THE CONDITIONS FOR REFORM

### Educating Teachers for a Student-Centered Pedagogy

Paul Grand'Maison and Jacques E. Des Marchais

*What's hardest is not lighting  
the fire, but keeping it hot.*

What is the most important component in building a house? The plans? The materials? The workers? The workers' skill? The owner? What about the most important component of an educational program: Is it the objectives? The students? The teachers? The educational methods? Assessment? It is all five: the close interrelations and balance among all these components ensure the success of any educational program.

What is the most important component in changing a program? The students? True and false. Certainly they are at the heart of any program, but their ability to adjust is great. They can act as a force for change. The educational methods and their objectives? This answer is partly right, and is all the more appealing since this is the most easily observed component. If educational methods have not changed, can we really say the program has changed? Is it the teachers? They can wholly transform an educational program or stymie all effort at change. Assessment? Well, it is true that "evaluation drives the curriculum". This certainly does represent a major component.

Students, methods, objectives, teachers, and assessment are all essential components in successful program change. In our setting, however, teachers were the hub of the process of change begun in 1987. The Dean of the Faculty was clearly alive to this when, in 1984, he assigned the Office of Faculty Development (OFD) the specific mandate of preparing teachers for early implementation of changes in teaching methods in the curriculum.

Over the years, owing to the reform, we reached the somewhat subjective conviction that there was an ineluctable need to provide significant education in teaching methods to those who were called upon to transform, develop, and administer medical education programs. Unless teachers' educational philosophy was modified and they acquired a degree of competency in the management of pedagogical processes, there could be no true change. This conviction was strengthened by the seminars we organized and directed in Europe.

Education in teaching methods does not necessarily lead to the transformation of programs, as was believed by the World Health Organization in the seventies (Guilbert, 1981). WHO's position on the matter nevertheless gave rise to a burgeoning of offices of

medical education (Miller, 1980), especially in North America, and elicited numerous innovations in teaching-and-learning. In our view, however, a medical education program can only be transformed by a faculty's management if teachers take ownership of it. What was needed, therefore, was to instruct and educate teachers in educational sciences as applied to medicine; i.e., in medical education. That is how we interpreted Recommendation 4 of Conclusion 5 of the GPEP Report (Association of American Medical Colleges, 1984), which calls for increasing the faculty's teaching ability and helping them go beyond the limits of their disciplines. Teachers are thus called upon not just to transmit knowledge but to become guides or mentors who create a setting favorable to learning.

In order to transform teachers' mindset and enable them to acquire new competencies, from 1984 to 1992 the OFD offered the faculty four programs. The OFD evaluated the results of these (Grand'Maisdon et al., 1991). Questions asked were: How can teachers' interest be elicited in education and medical education? How can they be brought to adopt a student-centered educational philosophy and to make a commitment to the process of change?

## Programs of Education in Teaching Methods

When it was created in 1984, the OFD, which answers directly to the Academic Vice-Dean, was assigned the mission of improving the process of teaching-and-learning in the Faculty of Medicine through training, service, and research activities. From 1984 to 1992, educational activities were the priority. From 1984 to 1988, Paul Grand'Maison, a clinician with a background in education, ran these on a half-time basis. Some ten clinician-teachers came to his aid, dedicating 10% to 20% of their professional time to this project, which gathered momentum.

### *Introduction to health-sciences education*

The OFD first prepared an introductory workshop on health-sciences education. Lasting two days, this workshop was meant to awaken teachers' interest in medical education and student-centered pedagogy. Teachers learned the phases of systemic teacher planning of educational activities, following Guilbert's model (Guilbert, 1990), which sets up the sequence *definition of objectives - planning assessment - program implementation - assessment*. The workshop also allowed for discussion of themes such as self-directed learning, student motivation, and community-oriented education.

The workshop's contents and procedures were largely based on Guilbert's *Guide pédagogique pour les personnels de santé* (Guilbert, 1990), as adapted to the specific context of our reform. The workshop method respected the process of self-directed learning but provided appropriate support. It targeted maximum participation by all through individual work activities, small-group discussions, and plenary sessions. The

plenaries served to identify the lessons and conclusions drawn (Table I). J.-J. Guilbert himself conducted the first workshop in May 1985, acting as a consultant. Subsequent ones were conducted by members of the OFD.

This introduction was considered essential for every teacher new to our setting. The atmosphere of the workshops is relaxed, but work is intense. This is a climate that promotes discovery of concepts that most participants arrive with little knowledge of. It is through the themes of student motivation and self-directed learning that participants are introduced to student-centered pedagogy.

Table I. Introductory workshop on health-sciences education

<b>THE EVENING BEFORE THE WORKSHOP</b>  7:00 p.m. to 8:15 p.m.	Introduction to the workshop
<b>DAY 1</b>  Morning  Afternoon  <b>DAY 2</b>	Stimulating student motivation and autonomy Identifying learning needs Determining learning objectives Selecting teaching-and-learning activities
Morning  Afternoon	Becoming acquainted with problem-based learning Planning and implementing assessment

*The one-year basic program in medical education*

After this initial contact with health-sciences education, teachers are ready to embark on a deeper, systematic process of education in teaching methods. The OFD invested a good deal of energy in setting up this program, which came to exert a profound influence on many teachers in the Faculty of Medicine. We owe its origins, in 1979, to the Unité de recherche et de développement en éducation médicale (URDEM) at Université de Montréal (Des Marchais et al., 1990). Lasting a whole academic year, the program requires participants to make a significant commitment, estimated at a minimum of 100 hours of work. Like a sabbatical leave, it constitutes an attractive solution for those teachers in the Faculty who want deeper training than that offered by brief workshops. It offers them the advantage that they do not have to leave the professional setting in which they conduct their research or clinical work.

Our aim was to make a permanent change in traditional attitudes. Through the program, teachers come to assign more importance to the student learning than to the teacher teaching. From here on in, effective teaching must be viewed as teaching that can help students learn. Participants in the program are encouraged to master the scientific bases of medical education through a systematic encounter with each component of any educational program. They make an effort to assimilate knowledge and skills in teaching-and-learning in order to apply them to their teaching activities.

The fundamental concepts of medical education are presented in a series of seventeen themes (Table II). The number of themes and the order in which they are presented can vary from one year to another, according to participants' needs and knowledge base. The themes are organized following a model of curriculum planning for learning in current use (Figure 1). In this model, each part of a learning activity is viewed as a component in an overall system all of whose components are interconnected.

Each theme is studied using a self-directed learning module developed by the program's designers. The modules are grouped into five workbooks (Jean et al., 1990) containing a total of 574 pages. The program relies on two learning methods, self-directed learning and small-group discussion. For each theme, the teaching process makes use of a three-tiered approach (Table III):

- 1) comprehension: attained by acquiring basic teaching-and-learning concepts through reading and carrying out short exercises constructed around the "input-practice-feedback" sequence;
- 2) analysis: participants are asked to solve fictional cases requiring use of the new concepts;
- 3) application of the new knowledge to participants' own teaching activities.

At the outset participants are asked to choose a personal teaching project to be developed in stages over the course of the program. Every three or four weeks they meet in small groups of four to six members to discuss their individual work and the ways they are applying their personal teaching projects. Thus teachers learn from and with their peers. They make an effort to receive and give feedback regularly.

A teaching colleague - who must always be a clinician - acts as group leader and, when needed, a resource person to ensure the contents are well grasped. This person never, however, agrees to convey information or adopt the role of a classroom teacher. A one-day session held at the end provides an opportunity to synthesize what has been learned. Each participant is expected to invest six to ten hours of individual work in preparing for each session. Thus all the various exercises require a total of 100 to 125 hours of individual work if one wishes to see through the whole program and master objectives specific to the study and application of each theme.

Table II. Themes in the one-year basic program in medical education

<b>SYSTEMATIC PROCEDURES</b> <ol style="list-style-type: none"><li>1. Systemic teacher planning</li><li>2. Determining educational needs</li><li>3. Formulating learning objectives</li></ol>
<b>LEARNING METHODS</b> <ol style="list-style-type: none"><li>4. Choosing a means to achieve a learning objective</li><li>5. Group leadership</li><li>6. Self-directed-learning module</li><li>7. Lecture-style teaching and audio-visual methods</li><li>8. Problem-based learning</li><li>9. Workshop on teaching methods</li><li>10. Clinical preceptorships</li><li>11. Demonstrations and labs</li></ol>
<b>ASSESSMENT AND EVALUATION</b> <ol style="list-style-type: none"><li>12. Choosing an appropriate measuring instrument</li><li>13. Assessing knowledge</li><li>14. Assessing behavior and attitudes</li><li>15. Evaluating an educational activity or program</li></ol>
<b>THE STUDENT AND THE SETTING</b> <ol style="list-style-type: none"><li>16. The student's motivation as a facilitator for learning</li><li>17. Successful changes in teaching in one's own setting</li></ol>

Table III. Components in the learning process

Levels of Learning	OBJECTIVES	ACTIVITIES	EVALUATION
1	Knowledge acquisition	Reading text Answering questions	Model answers
2	Analysis Solving	Working on fictional cases	Decoding cases
3	Application of knowledge	Developing personal project	Peer criticism Field testing



Ref.: Jean P., DesMarchais J.E., Delorme P. - URDEM

Figure 1. Systematic steps in curriculum planning (Jean et al., 1990)

In 1984-85, the designers of URDEM offered this program to fourteen teachers in Sherbrooke's Faculty of Medicine. From these, they chose four whom they trained to run the program the following year, as instructors and small-group leaders. Since that time, the program, which has been offered every year, has always used the documentation produced by its designers (Jean et al., 1990). Some fifteen teachers who took the program and received group-leadership training acted as instructors and group leaders from 1985 to 1992.

*Introduction to problem-based learning*

The third program, a one-day workshop, was designed to help teachers become acquainted with PBL, develop an interest in adopting it, acquire the necessary skills for problem writing, and familiarize themselves with the role of tutor. The workshop includes theoretical explanations of PBL, small-group discussions, readings, PBL-type problem production, and individual trials of this method of learning using a non-medical problem (see Annex 1). Participants then practice the role of tutor with medical students. All this is accompanied by observation and feedback exercises. Trying out the role of tutor ensures the program is properly centered on the student (Table IV).

Table IV. Introduction to problem-based learning

Morning
<ul style="list-style-type: none"><li>• PBL: its objectives and its methods of application</li><li>• Devising problems and covering concepts</li><li>• Test and validation of problems devised</li></ul>
Afternoon
<ul style="list-style-type: none"><li>• Individual trial of PBL with a non-medical problem</li><li>• Trying out the role of tutor using a problem constructed in the morning</li><li>• Discussion of the justifications for PBL</li></ul>

The contents of this workshop were designed with the studies by Schmidt (Schmidt, 1983) and Walton and Matthews (Walton et al., 1989) and the classic work of Barrows (Barrows et al., 1980; Barrows, 1988) as guides. Henk Schmidt himself conducted our first workshop over two days in September 1986, in preparation for the program's implementation the following year. In November, during the second workshop, he supervised the training of members of the OFD so that they could take on responsibility for subsequent workshops. Twelve such workshops were offered from 1987 to 1992.

From 1987 to 1990, those running the MD program considered participation in this workshop to be a prerequisite to tutor training. Once a collective experience of PBL itself was established, the need for such a workshop declined. Little by little, it became difficult to plan for it before the basic tutor-training workshop. From 1992 on, therefore, various components of this introductory workshop on PBL were gradually incorporated into the tutor-training workshop, annual upgrading workshops, and the introductory workshop on health-sciences education. The introductory workshop on PBL is also still being included in most three- or four-day seminars offered to visitors several times a year, and colleagues from throughout the region are invited to these.

### *The tutor-training program*

The aim of the training program for tutors is to enable teachers to assimilate problem-based learning, understand the tutor's responsibilities, acquire the skills needed to accomplish them, and analyze specific situations in tutorials in order to take effective action (Des Marchais et al., 1997).

The program (see Chapter 9) was designed as a continuous educational process. Three weeks beforehand, at a two-hour meeting, participants discuss tutor responsibilities and identify their learning needs. They are then called upon to observe the overall PBL process as applied to a given problem, in two tutorials. Three weeks later, they participate in a two-day workshop to deepen their understanding of the tutor's responsibilities and acquire the pertinent related skills through a series of exercises and by engaging in a tutorial with students. This first experience as a tutor is thus presented as one stage in the educational process. Since this is a program of continuing education, the experience serves as underpinning for the annual half-day of upgrading offered to all from 1988 on.

Monique Chaput, an adult-education consultant, was given the mandate to develop and run the tutor-training program in collaboration with the members of the OFD. The first workshop was offered in August 1987, a scant few weeks before the start of the new program. Since then it has been offered annually.

## The Experience from 1984 to 1995

Evaluating a program for teaching development is never easy. How have our programs evolved? How are they structured? Who participates in them? How satisfied are participants and what is their interest in continuing their education? And last, what lessons can be drawn from our experiences? These are the questions we will now try to answer.

### *Program development*

During all these years, the Faculty's and the OFD's pedagogical resources remained somewhat limited. They consisted essentially of the Academic Vice-Dean, the director of

the OFD, and certain clinicians having great good will but no relevant training, who agreed to collaborate in order to develop other abilities and competencies. These limitations obliged us to adopt a strategy designed to maximize collaboration between outside experts and teachers in the Faculty of Medicine wishing to increase their teaching competencies. Our objective was to facilitate transfer of knowledge from the former to the latter.

Once our needs had been identified, in particular our institutional and normative needs, resource people, who were often outside experts, were invited to develop and carry out a program's first version. Local educators participated in the process, watching it intently and discussing how it unfolded. The second version was generally given by local educators, most often with the collaboration and under the supervision of the outside expert. These educators were expected subsequently to be able to offer the program again without significant changes to the process. From 1984 to 1995, over twenty teachers, all of them full-time clinicians, collaborated in this process and thus acquired a high level of education in teaching methods.

This development strategy has served our institutional needs very well since 1984. Besides promoting judicious use of limited financial resources, it allowed us to develop a significant number of programs and rapidly increase the number of local educators, all the while creating a core who facilitated the transformations required by the implementation of the PBL program.

Finally, this strategy benefited from the fact that those who cooperated with the OFD had links to numerous departments: pediatrics, psychiatry, radiology, anesthetics, cardiology, otorhinolaryngology, family medicine, obstetrics-gynecology, internal medicine, and neurology. Each of them became an ambassador for medical education and the new program within these departments.

There were nevertheless disadvantages to this strategy. Educator-teachers did not acquire sufficient competency to enable them to develop new pedagogical programs. Each time they offered a program anew, they rapidly transmitted specific, limited competencies and skills that, lacking theoretical training, they could not base on an appropriate frame of reference. This risked undermining a program's quality and making it superficial, not to say flat or ill-suited to the needs of the evolving clientele. This difficulty was mitigated, it is true, whenever an educator-teacher obtained specific teacher education. Such individuals then became able to assume responsibility for a program's quality, gradually becoming, indeed, "mentors" to their colleagues. But the educator's activities must receive recognition from the Faculty and contribute to the individual's academic promotion.

### *How programs are structured*

The Faculty's series of programs for teaching development fit into a kind of hierarchy that provides an optimal sequence for any teacher wishing to follow all of them (Figure 2). The

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sequence begins with an introduction to health-sciences education, which is considered essential for every new teacher and initiates the participant into the concepts of medical education. Ideally, every teacher should then enroll in the basic program in medical education, which, besides promoting the acquisition of fundamental concepts, also fosters development of a student-centered attitude. This program in turn leads the teacher to embark on a personal teaching project. The sequence ends with two specific programs, one that introduces teachers to PBL and another that trains them to serve as tutors. All of this is complemented by our annual upgrading sessions. The basic program in medical education and the tutor training are offered each year. The introductory workshop in health-sciences education and the tutor-training workshop are considered obligatory for anyone acting as a tutor.

In reality, not all teachers in the Faculty have followed this ideal sequence. In the early years, during the gradual implementation of the reform, programs were more accessible. They were offered more than once a year, as the Faculty of Medicine required. Today, for logistical reasons, the Faculty prefers an experiential approach, with experience in a given role often preceding the workshop designed to prepare one for that role.

From 1986 to 1989, the introductory workshop on PBL seemed, according to those responsible for it, to have the greatest influence on implementation of our teaching reform. This workshop, combined with the one to train tutors, allowed for the acquisition of the skills needed in implementing PBL problems and functioning effectively as a tutor. Without these programs it would have been difficult to implement problem-based learning.

#### *Who participates*

A large proportion of teaching staff in the Faculty of Medicine participated in the program of education in teaching methods offered from September 1984 to June 1995 (Table V).

This high level of participation, which exceeds that reported in the research literature (Jason et al., 1982),<sup>13</sup> can be explained as follows:

- Since the introductory workshop on health-sciences education has been considered *essential* for every new teacher in the Faculty since 1988, teachers have many incentives to participate in it. Since spring of 1992, under a directive from the Dean, every department head is to some degree responsible for "eliciting" newly recruited teachers' participation.
- The introductory workshop on PBL and the tutor training program were declared obligatory for every teacher who wishes to be a tutor. The message was clearly transmitted to all those responsible for units and to all interested parties. Anxiety about being called upon to fill such a new role prompted teachers to take advantage of this training opportunity.

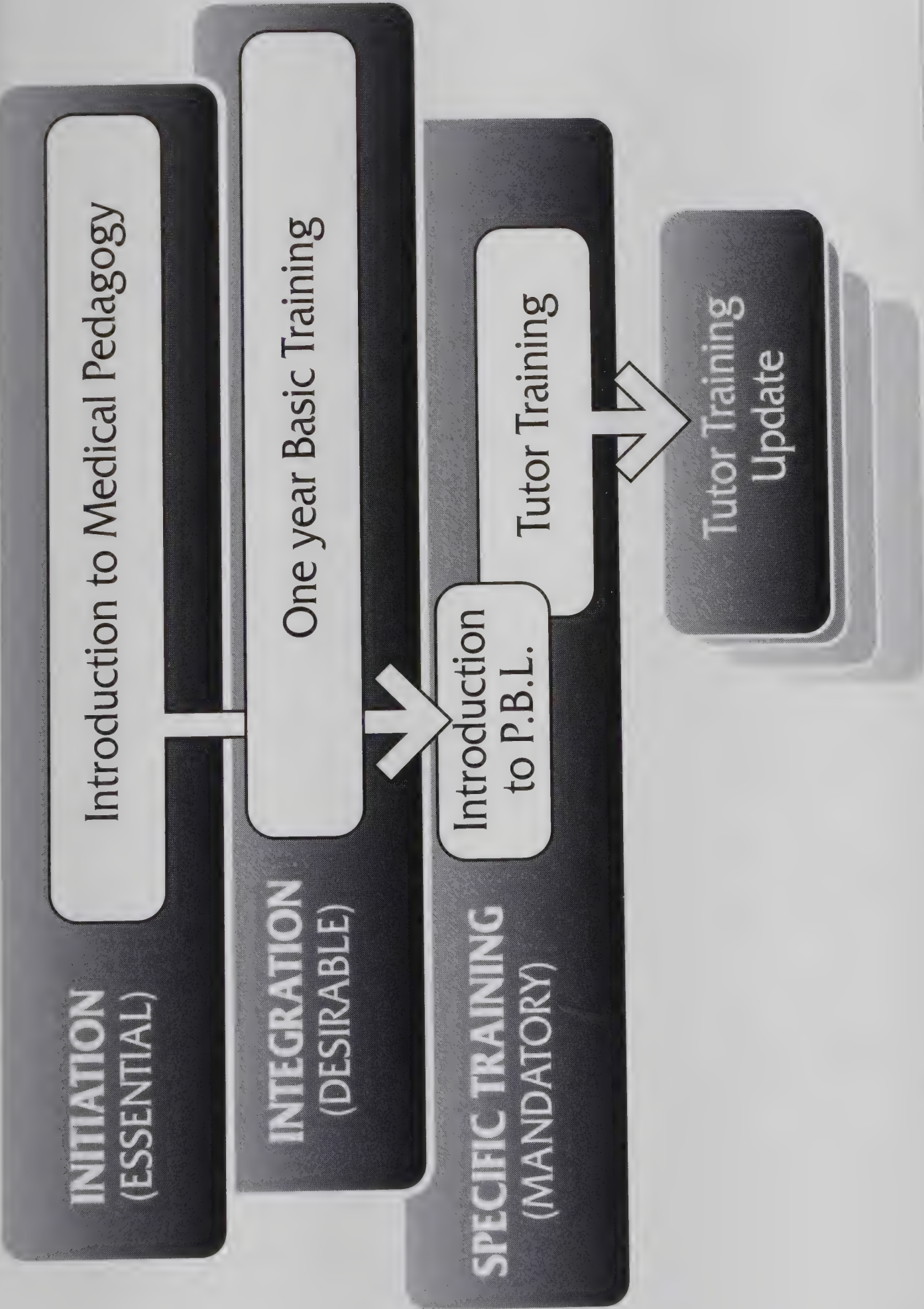


Figure 2. Faculty development programs

Table V. Participants in programs of education in teaching

ACTIVITY	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	TOTAL	%FULL TIME (N=290)
INTRODUCTION TO HEALTH-SCIENCES EDUCATION	20	68	16	11	7	2	13	14	8	7	12	178	61.4%
basic program in medical education*	12	17	15	7	11	6	10	11	11	5	7	112	38.7%
INTRODUCTION TO PROBLEM-BASED LEARNING			81	44	23	6	13	NIL	NIL	NIL	NIL	167	57.6%
PBL TUTOR TRAINING				72	70	26	10	26	9	31	25	272	93.8%
PBL TUTOR UPGRADING					41	100	113	142	151	134	BIL	681	**
CRL*** FACILITATOR UPGRADING										17	21	38	***

\* A program of 12 monthly meetings, each preceded by individual work (over 100 hours).  
\*\* Workshops offered annually (no calculation of percentage).  
\*\*\* New workshop launched in 1993-94 (CRL = clinical-reasoning learning)

- Revision and implementation of the new program were viewed as a collective responsibility, a Faculty of Medicine objective that every member of faculty must contribute to.
- Members of the Faculty's top management responsible for academic affairs exercised continuous and unambiguous pressure on those teachers most directly concerned by implementation of the PBL program. Management wanted to be sure of their participation not only in the introductory workshop, but above all in the basic program in medical education. Most of the new program's supporters were indeed recruited from among individuals who had taken this training.
- The Faculty of Medicine's method of remuneration, in particular, the method of calculating remuneration for teaching activities (see Chapter 10), relieves teachers of pressure to "generate dollars" and remunerates them appropriately for their teaching responsibilities.
- The winds of change blowing over the Faculty during the past few years have created strong social pressures favoring participation in these programs. Education in teaching methods is part of the general process of adaptation to change; involvement in it means being a part of the group and assenting to a prevailing trend in teaching circles.

Failure to participate by some can be explained in more than one way. Under the system for managing the Faculty's tripartite mission - teaching, research, and care of the sick (See Chapter 10) - some professors devote their time wholly to research and are not involved in the MD program. Others claim to have acquired these skills by osmosis and experience!

Certain teachers who have not taken a single one of the workshops are considered by students to be excellent tutors. We must acknowledge that no program can replace individual talent and, above all, an irrepressible interest in students.

It is interesting to observe the participation rate in programs of education in teaching methods in light of teachers' disciplinary affiliations (Table VI). The number of participants from the basic sciences is higher than what is generally seen in medical faculties (Jean et al., 1990; Jason et al., 1982)).

The dropout rate is relatively low, below 5% (except in the basic program, where some years it reaches around 25%), and indeed, in 1994-95, nonexistent. This can be accounted for by the shorter duration of the workshops and the importance they are assigned by the Faculty of Medicine's management. The dropout rate for the basic program is higher than that seen in other medical faculties.<sup>6</sup> There are three factors that could account for this. First, teachers in Sherbrooke's Faculty of Medicine have claims made on their attention by a large number of programs of education in teaching methods. The highly demanding reform to the MD program leaves little free time. Finally, some people enroll as the result of outside pressure but lack the motivation to persevere with the heavy workload.

Since 1988, part-time teachers have also been welcome to participate in these programs, with the goal of increasing their contribution to preclinical teaching. It was necessary first to prepare implementation, in April 1990, of the new clerkship, with which these teachers were heavily involved. In the past few years, keen interest in the introductory workshop on health-sciences education has been observed among part-time teachers. In fact, a workshop on this was even organized in springtime of 1990 for 25 participants in a region located 500 kilometers away from Sherbrooke, where numerous clinical teachers were involved in postgraduate education in family medicine. Another workshop took place in a major hospital located 150 kilometers from Sherbrooke.

Table VI. Backgrounds of participants\* in programs of education in teaching methods

PROGRAM	DEPARTMENT					
	BASIC SCIENCE	MEDICINE	SURGERY	FAMILY MEDICINE	OTHER**	TOTAL
Introduction to health-sciences education	24	50	25	15	64	178
Basic program in medical education	12	25	14	20	45	116
Introduction to problem-based learning	36	37	20	14	60	167
Basic PBL tutor training	40	70	35	42	94	281
PBL tutor upgrading***	106	204	79	62	207	658

- \* Full-time teachers, from 1984 to 1995.
- \*\* Anesthesia-resuscitation, obstetrics-gynecology, pathology, pediatrics, psychiatry, radiology, community health, nursing sciences.
- \*\*\* Offered annually.

It is not usually difficult to get teachers' participation in a program's first runs. The very first workshops drew those who were prepared to make an early commitment to the teaching reform. Their interest and their involvement in the program's development led to their heightened sense of their need for specific education in teaching methods. The role of PBL tutor was so new and gave rise to such insecurity that many of them were impatient to take part in the first workshops. During the first years (1984-88), full-time teachers were strongly drawn to the educational program, which is how the participation rate by full-time teachers shown in Table V was attained. In subsequent years, these percentages increased less rapidly, except in the basic program, which went from 29% to 39% in three years. In the latter years it was necessary to work harder to stimulate interest by the target group of full-time teachers. A certain degree of disaffection may be observed. It has to be admitted that the teaching reform no longer constituted a priority for the Faculty in the way it did from 1985 to 1988.

### *Participant satisfaction*

At the end of each program, participants fill in a questionnaire designed to evaluate their level of satisfaction, which has proven to be very high. Interest in pedagogy increases. Participants become more concerned about their own teaching development. These results are comparable to those observed in similar programs (Jean et al., 1990).

For many teachers, participation in these programs constitutes a powerful stimulus to get more intensely involved in the Faculty of Medicine's teaching-related activities. In 1986, only one teacher had a formal background in medical education. In 1995, four other teachers, all physicians, had completed their master's in education or were about to do so. All were actively involved in giving their colleagues teacher education.

### Lessons to be Drawn

The experience of these few years has allowed us to learn certain lessons about teaching development linked to program change:

- Reform of the MD program leading to the adoption of Problem-based Learning gave rise to a whole range of institutional, normative, and individual educational needs that have been in constant development as the years have passed.
- Teaching development must be capable of continually adjusting to clearly identified educational needs that constantly evolve. If need be, you must be ready to modify some programs.
- Since 1984, teaching development programs have met the educational needs of teachers and the Faculty, as is acknowledged by participants themselves, promoters of the change, external consultants, and last, in 1989, members of the Liaison Committee on Medical Education and the Royal College's Committee on Accreditation of Canadian Medical Schools.
- The goal of all of these activities is gradual change in the attitudes of teaching staff towards student-teacher interaction. The idea is that the teacher should increasingly become a facilitator of the student's learning rather than a simple purveyor of information.
- The Faculty of Medicine is convinced that without such change it would have been nearly impossible to carry out the teaching reform begun in September 1987.
- A change of attitudes comes about slowly. The activities necessary to getting it started and to sustaining it must begin before a program is changed and continue for a long time afterwards.
- To launch into a major change of this kind, a medical faculty must be able to count on a small group of professors who are not only interested in promoting medical education but are above all dedicated, ready to learn, and committed to deepening their understanding of education.

- A medical faculty's leadership must encourage and maintain the commitment and enthusiasm of teachers dedicated to the cause of medical education.
- In order for such a group of teachers to develop, there must be at least one mentor among them. This mentor must provide support to teachers, not just in organizing teaching-related activities with an assurance of quality, but also in their individual teaching development.
- The wheel should not be reinvented every time a new need is felt. Calling on outside experts is beneficial from every point of view, but their mandate must be clear: to transfer a part of their experience and competency to teachers who are ready to take up the baton. At Sherbrooke this strategy proved very fruitful.

## Conclusion

Since 1984, a series of four programs for teaching development has been offered to our teachers. These programs enjoy a high participation rate. They are much appreciated and contribute to enhanced interest in medical education and to modifying teachers' educational philosophy. They make it possible for them to acquire efficiently the skills needed to put the new PBL program into practice.

Many factors contribute to the success of a program change: unequivocal political will by the leadership; adequate experience in education and knowledge of the theory of change on the part of promoters; and an appropriate faculty system for acknowledging teachers' accomplishments. Teachers' educational development remains one of the most crucial components, however. Education in teaching methods has remained a priority of the Faculty's management throughout the years of reform.

Even though it is hard to establish a definite correlation between the success experienced at Sherbrooke and the education in teaching methods provided to the teaching staff, the large majority of the new program's promoters think that this correlation exists. Our experience has confirmed that teaching development is an essential prerequisite to any program change in a medical faculty.

All this teaching-related activity peaked in May 1992. The Faculty of Medicine hired two full professors from the University of Sherbrooke's Faculty of Education to revitalize the Office of Faculty Development and transform it into a Medical Education Research and Development Center. One of them became its full-time head and introduced features of cognitive psychology. It was now possible for a master's in education from the Faculty of Education to be on issues in medical education. New activities were developed: training workshops for the role of facilitator for the clinical-reasoning learning sessions; a master's course in cognitive psychology; and research seminars. Some teachers undertook study of

students' learning processes. Several projects received funding from prestigious organizations. Henceforward, medical education had a secure place in the University.

The reform of the MD program has produced a setting that cries out for studies and research projects in medical education. The Faculty of Medicine has decided to invest in basic and applied research on education in order to enrich practice that, over the course of these years, has become an amazingly productive laboratory.

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## ANNEX 1

### *Problems used in Introducing teachers to PBL*

#### "IT'S RAINING"

Imagine a warm and humid day. The air is full of little particles. At the end of the afternoon, clouds gather and the weather seems to be getting even more humid.

Suddenly, lightning flashes in the distance, followed by a peal of thunder. A downpour begins; a storm is upon you.

(H. Schmidt)

#### "SAILING"

You're spending your holidays on Île d'Orléans, near Quebec City. Your daughter has persuaded you to buy a rowboat that you've rigged out with a centerboard, a mast, and sails. The day that your boat is launched your crew consists of your spouse, your daughter, and her friend. Sailing with a strong east wind, sail full out, you head south-southwest, with the wind to port.

You lower the centerboard and presto! all three of you are overboard! What happened?

## Training Teachers for the Tutor Role

Monique Chaput and Jacques E. Des Marchais

*Saying you know when you know  
and you don't know when you don't know:  
that's knowledge  
- Confucius*

The academic year 1986-87 was marked by feverish preparations to implement problem-based learning. Henk Schmidt of Maastricht had already come over to explain and model the role of tutor. Knowing how to tutor did not come on its own, especially considering that group leadership for tutorial meetings was to be frequently assigned to students.

What qualities must be acquired? What competencies must be used and improved in order to play the role satisfactorily during a tutorial? Teachers were eagerly expecting answers to these questions from their training workshops. Was the tutor to be a facilitator of group learning, or an expert on content? Many, especially those in the basic sciences, were hoping to play the role of expert about problems they knew well; they faced doubts, however, about their ability to make contributions about other problems.

Member institutions in the Network: Community Partnerships for Health through Innovative Education, Service, and Research (the former Network of Community-Oriented Educational Institutions for the Health Sciences) had adopted diverse solutions in response to these questions. No medical faculty, however, had yet conducted as comprehensive a change as that being undertaken by Sherbrooke's Faculty of Medicine.

This was the context in which the training program for tutors was developed with the help of an adult-education consultant. It was necessary to do everything from scratch: identify tutors' responsibilities, develop a training program enabling them to acquire the competencies needed, and, if possible, devise a tutor-evaluation grid.

### The Problem

In an institution that is radically transforming its curriculum in favor of the problem-based learning method, two essential tasks must be carried out: problem building and preparing teachers to fill the role of tutor properly. For teachers, the change is fundamental: they are being called upon to trade in the role of knowledge transmitter for that of guide to learning. In a traditional curriculum, teachers convey the subject matter covered by the program

almost exclusively through lectures complemented with slides and handout materials. Professors are hired for their competency in some field of medical science, and students view them as experts whose job is to transmit content.

*The role of expert versus the role of tutor*

The PBL method leaves very little room for the role of "content transmitter". But if tutors are not called upon to give lectures, need they continue to be experts on content? The answer to this question provides the beginnings of a definition of tutors' work, and thus, the development of a training program.

Barrows maintains that a tutor who is not an expert on content is incapable of guiding students towards the learning objectives and judging whether the ideas they express and the facts they retain are correct or incorrect (Barrows, 1988). He says, however:

There is no question that the ideal circumstance is for the tutor to be expert both as a tutor and in the discipline being studied by the students. However, if this is not possible, the next best tutor is the teacher who is good at being a tutor...though not an expert in the discipline being studied.

In contrast, following a study that covered 1120 students and 152 tutors, Schmidt concluded:

It seems that Barrows' assumption that tutors do not really need domain knowledge in order to facilitate student learning is not justified, at least not with regard to the curriculum studied. Tutorial groups guided by a content-expert tutor work harder and achieve better (Schmidt et al., 1993).

For his part, Silver studied the effects of the tutor's content expertise on group functioning. He showed that, even though students see no difference in PBL group functioning whether the tutor is expert or not, tutors prove to be more active and students more passive in discussion on topics lying within the tutor's field of expertise. Expert tutors answer questions more, take more time with their responses, determine more of the points discussed, and elicit more tutor-centered interaction and consequently less interaction among students (Silver, 1989).

Davis et al. studied the effect of tutor expertise on small-group functioning, students' satisfaction, and their performance on an examination bearing on the subject matter covered by the problem. The results showed that the percentage of time controlled by tutors is higher for expert tutors (15.5% on average) than non-expert (12.2% on average). Students with an expert tutor rate their experience higher than students with a non-expert tutor. Students with an expert tutor get mean results of 544.4 (standard deviation = 92.6) and students with a non-expert tutor, a result of 451.2 (standard deviation = 87.4) with a standardized mean of 500 (standard deviation = 100) (Davis et al., 1992).

These two studies yielded similar results and show that expert tutors have an inhibiting effect on student initiative. Davis's study reveals the benefits of having expert tutors when it comes time for learning to be assessed by multiple-choice questions (MCQs).

A study on this carried out in our own Faculty of Medicine showed no significant difference in examination results, even in the performance on problem-analysis questions (PAQs) between students with expert and non-expert tutors. Students rated non-expert tutors as highly as experts when they evaluated a unit, even though at the outset they may have preferred an expert tutor. The only factor that yielded a difference in favor of experts was *tutor's knowledge* (Lesage-Jarjoura et al., 1990). Numerous other research studies, in particular the work of Hill, Rabe, and Swanson et al., reached the same conclusion: use of a non-expert tutor does not seem to hinder student learning (Hill, 1969; Rabe, 1973; Swanson et al., 1990). On the other hand, Patel et al. suggest that non-expert tutors may lead students to learn errors, and that this might explain the lower performance by a group of PBL students when compared to a group receiving traditional teaching (Patel et al., 1991).

The Faculty of Law at Maastricht University (the former University of Limburg) in the Netherlands experimented with recruiting third-year students in a four-year program as tutors. Studies comparing their performance with that of professor-tutors showed no difference between student results in examinations composed of essay-type questions, that is, no greater than the difference between students with a non-expert tutor and those with an expert tutor. In one of two groups with a student tutor, though, participants spent much more time on individual work. The study concludes that as tutors, students are no less effective than professors (Moust et al., 1990).

In universities using PBL, what practice is most commonly followed in response to the expert/non-expert issue (Des Marchais, 1987)? At Egypt's Suez Canal University, tutors must be members of the medical faculty's regular teaching staff. At the University of Newcastle in Australia, tutors must be from the medical sciences and have an adequate knowledge of fundamental physiological mechanisms. At the University of Limburg in Maastricht, tutors are not subject-matter experts. At the University of New Mexico, the directors of the program prefer tutors who are novices about content to subject-matter experts. It is worth noting observations by Lucero et al. about this university, however:

We have increasingly matched tutors with particular units on the basis of their expertise on the subject matter of the unit's cases. However, we do this as a recruiting device more for the comfort of particular tutors than the learning needs of the students (Lucero et al., 1985)

At Sherbrooke, non-expert tutors envied colleagues working within their own field of expertise. Many spent long hours preparing a problem's subject matter, especially the first time they taught a particular unit. During those first years, those who were satisfied to play the role of facilitator were few. Conscientious tutors seemed to want to know not just how

to captain the ship but where to take it. Tutors were inclined to think that, reassured by expert tutors, students valued them to the point of seeing them as a yardstick of performance. At the outset, many feared that students with non-expert tutors would get lower grades on exams.

During the years of the reform’s planning and implementation, the Program Director and the vice-dean juggled with the elements of this complex problem before putting forward criteria for competency likely to produce predictable results in tutor performance. Their time of reflection led in the end to broad consensus (Table I).

Table I. Criteria of effectiveness in the role of tutor

CRITERION			ROLE OF TUTOR	
Tutors knowledgeable about				
CONTENT	+	PROCESS	➡	EXPECTED RESULTS
STRONG	+	WEAK	➡	NON-VIABLE
WEAK	+	STRONG	➡	VIABLE
STRONG	+	STRONG	➡	HIGHLY DESIRABLE
"KNOWLEDGEABLE"	+	STRONG	➡	APPROPRIATE AT SHERBROOKE

We feared that a tutor who was strong on content but weak on process might transform tutorials into mini-lectures. In contrast, all the research shows that a tutor who is weak on content but strong on process gives a *viable* performance, where the process relates as much to PBL stages as on small-group leadership. Naturally, everyone, like Barrows, would like tutors who are strong in both spheres. Taking account of Sherbrooke’s reform initiative as a whole, we opted in the end for a position based on appropriateness: a tutor strong on process and *knowledgeable* about content.

Tutors were recruited from among *professors who were adequately familiar with a unit’s subject matter* (for example, a radiologist with specific competency in neurology could be recruited for the unit on neurology) and not exclusively from among content experts (which would have meant, for example, reserving psychiatrists for the psychiatry component). If a professor was not very *knowledgeable* about content (for example, an obstetrician-gynecologist surgeon acting as tutor for the unit on the urinary system), she or he would have to prepare subject matter using the *Tutor Handbook* and suggested readings. In our Faculty of Medicine, however, there was no question of using tutors who were not physicians, with the rare exception of psychologists who were already members of the Faculty’s teaching staff. This final decision to recruit *teachers who were adequately familiar with a unit’s subject matter* as tutors was based on the need to be able to count on an adequate number of tutors, which was strategically important to the implementation phase.

*Training for the tutor role*

It is our belief that educating the teaching staff is a crucial component in setting up a PBL system. Under the traditional system, future teachers benefited from the example set by exceptional teachers of their own, who served as an inspiration in their teaching of medicine.

The role of tutor presupposes that the professor-student relationship will be redefined and a whole range of new skills acquired (Bouhuijs, 1990). Implementing a PBL program obliges teachers to reframe their perceptions and develop new strategies for helping in the learning process. They must change from being conveyors of knowledge to facilitators of learning. Their new role calls for transformations on several fronts (Table II).

The first change relates to content itself. No longer is it possible to discuss the subject matter in segments. The clinical data presented by a problem must lead to student assimilation of the basic sciences. Teachers must forget their own needs and focus on those of students, who, for their part, must understand, assimilate, and retain medical science. Teachers must therefore concentrate more on the act of learning by the student. PBL requires tutors to master the principles and skills related to small-group leadership and to become acquainted with the features of a mode of learning focused on student autonomy.

Table II. Areas and kinds of change required of the tutor

SPHERE	CHANGE REQUIRED
Specific discipline	Integration of basic sciences with clinical sciences
Educational psychology	Use of a curriculum centered on the student and the learning process
Instructional methods	Problem-based learning: <ul style="list-style-type: none"><li>• Small-group learning</li><li>• Autonomous students</li></ul>

A change in teaching behavior of this kind can not be left to chance. The role of tutor is of prime importance in the successful implementation of a PBL system, a view endorsed by Barrows (Barrows, 1985).

How do universities that use PBL train their tutors (Des Marchais, 1987)? At Suez Canal University, tutor training consists of two stages: professors must first act as co-tutors for two or three months; then they take part in a four-day training session. No follow-up is provided for. At Maastricht University (the former University of Limburg), any professor wishing to become a tutor must first take a two-day introductory workshop. After having acted as tutors two or three times, professors are offered another workshop. Later on, if they

wish, they may attend a half-day follow-up meeting. At the University of Newcastle, the program comprises several stages. A first workshop entails two half-days of training, and a second, a further half-day. At the University of New Mexico the training program is experiential and lasts two-and-a-half days. Follow-up takes place at tutor weekly meetings, where they receive feedback and support. Barrows advocates competency-sharing between seasoned and novice tutors (Barrows, 1985).

In short, although tutor training is a concern for all, it is designed to suit different situations in different universities. Recurring tutor-training activities seem to be in place in all locations. Few research results are available, however, on the systematic planning of training activities.

### *An action-research project*

At Sherbrooke we undertook a long-term research project with the goal of studying various components of the role of tutor and an effective tutor's competencies. We wished in this way to put in place a suitable, consistent, and economical training program. We therefore opted for Kenny and Harnish's development and dialectical approach (Kenny et al., 1982). This research model, which is fundamentally exploratory and inductive, suited our requirements and constraints perfectly. The model works with the sequence Research - Practice - Theory - Practice.

Our choice of model was based on our will to incrementally build, through action, an integrated theory of the tutor role. This developmental model aimed in the first instance to build valid and reliable instruments using empirical data. Through the incremental addition of specific data, the practitioner-researcher gradually finds ever more suitable solutions to the problems she or he encounters and may eventually develop generalized theories to account for the circumstances experienced.

At the start, our research project was intended to answer four questions: What will the work of tutor at Sherbrooke consist of? What competencies must an effective tutor have? What training should the tutor be offered? How is the effectiveness of tutor performance to be evaluated?

## Developing a Training System

We began with the need to educate about 220 tutors for the first two years. At this stage, it was impossible to work with an approach centered on felt needs and individuals, because the planned change had triggered an outbreak of mistrust, and indeed resistance, among many teachers. As well, since these teachers had never observed or experienced PBL, they had difficulty envisaging their training needs. Our institutional approach thus tended to the normative, since a large number of teachers were able to participate in the introductory workshop on PBL (Chapter 8).

We chose a training system based on competency acquisition. This would both meet the Faculty's needs and awaken teachers' sense of the need for education and eventually upgrading. We used Davies' model of the stages required in developing such a system (Davies, 1973).

### *Analyzing the tutor role*

The first stage consisted of analyzing the system as a whole. We explored the different facets of the role of professor in a faculty of medicine, working from features specific to University of Sherbrooke. This allowed us to better define PBL's field of application while taking into account other roles such as that of clinician, researcher, rotation facilitator, coordinator, "boss", director, and so on. A single professor generally plays at least five or six such roles.

### *Task specification*

The second stage consisted of analyzing a tutor's tasks. We benefited from the knowledge acquired by some of the Faculty's teachers conducting the reform, who had done teaching internships in pioneer universities. A small task force identified eight tasks related to the tutor role and consistent with the major goals of the teaching reform (Table III). All this provided us with some reference points with which to build our training program.

### *Validating the task list*

Preparing a description of these tasks came to constitute a key process in the development of our training program, because they had to be validated. We therefore undertook two studies, one internal and the other external (Des Marchais et al., 1993).

Internally, over two years (1987 to 1989), tutors evaluated the significance of the eight tasks at three different points in their work: during the training workshop (TW), at the end of their first experience as unit tutors (UT), and at the point of embarking on their upgrading workshop (UW) (Table IV).

At all three evaluation points, the tasks of *facilitating small-group operation* and *stimulating motivation* were given top ranking (averaging a score of 4.3 out of 5) in order of importance. The task of *fostering autonomy* was ranked the same each time, second, with an average of 4.1. But *managing the PBL method*, which was in second place at the time of the training workshop, was in fifth place after four weeks teaching a unit and at the point of upgrading. There is an explanation for this result. For those designing change and for teachers, the task of managing the PBL method appears very important before the system is set in motion. But everyone discovered quite soon that this feature is quickly mastered by students, and that they themselves see to it that it unfolds properly. The responsibility for *guiding study of specific content* maintained the same rank, scoring 4.0 whatever the evaluation point. Last, the three tasks of *fostering humanism*, *assessing learning*, and *participating in academic administration* were ranked lowest. *Assessing learning* went up one level when the questionnaire was administered following the first experience of unit teaching, even though the average score it received had not risen significantly.

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Table III. Tasks related to the tutor role

- Manage the problem-based learning method
- Facilitate small-group functioning
- Guide study of specific content
- Foster autonomy
- Foster humanism
- Stimulate motivation
- Assess learning
- Participate in academic administration

For the external evaluation, 70 of the best tutors, as selected by a resource person from each institution using PBL (McMaster in Canada, Newcastle in Australia, Maastricht in the Netherlands, New Mexico in the U.S.A., and Ismalia in Egypt) conducted an evaluation of the significance assigned at Sherbrooke to the tasks identified. Table V shows the differences between the results obtained from the outside evaluators and those from 102 Sherbrooke tutors questioned after having filled the role for the first time. It is noteworthy

Table IV. Internal validation of identification of tutor task list

Tasks	Training workshop (TW)*	After 1 unit (UT)**	Upgrading workshop (UW)***	Overall mean
Manage the PBL method	4.2 (0.9)	3.8 (1.1)	3.8 (1.0)	3.9 (1.0)
Facilitate small-group functioning	4.5 (0.9)	4.2 (0.8)	4.3 (0.7)	4.3 (0.7)
Guide study of specific content	4.0 (0.9)	4.0 (1.0)	4.1 (0.8)	4.0 (0.9)
Foster autonomy	4.1 (0.7)	4.0 (0.9)	4.1 (1.0)	4.1 (0.9)
Foster humanism	3.9 (0.9)	3.7 (1.1)	3.6 (1.1)	3.7 (1.0)
Stimulate motivation	4.3 (0.7)	4.2 (0.9)	4.3 (0.9)	4.3 (0.8)
Assess learning	3.7 (1.0)	3.8 (1.0)	3.6 (0.9)	3.7 (1.0)
Participate in academic administration	3.3 (1.0)	3.2 (1.0)	3.1 (0.8)	3.2 (0.9)

\*N = 92      \*\*N = 33      \*\*\*N = 43      Maximum score = 5      ( ) = standard deviation

that the tasks of *managing the PBL method* is considered far more important by tutors in other universities than by those at Sherbrooke. Moreover, the latter consider the task of *stimulating motivation* more important than their colleagues in other institutions. The difference between the two groups in respect of these two tasks is significant ( $p < 0.006$  and  $p < 0.0002$ ). As well, the external tutors considered the task of *facilitating small-group functioning* much more important than those at Sherbrooke ( $p < 0.02$ ).

The study revealed several differences among the different medical schools in the Network, in particular in relation to two tasks, *stimulating motivation* (significant at 0.002) and *assessing learning* (0.000); both values are statistically significant.

Students at McMaster are on average 24 years old when admitted, in contrast to 19 at Maastricht. It is well known that it is easier to stimulate and sustain the motivation of older students. Moreover, Maastricht does not assess students, whereas Ismalia, New Mexico, and McMaster do. Based on this study validating the task list, it could be concluded that Sherbrooke's tutors were relatively more focused on student motivation (a score of 4.2), small-group functioning (4.2), and content (4.0). Those of the Network were more concerned with small-group functioning (4.5) and the learning method (4.3).

Table V. Internal and external validation of tutor task list

TASK	INTERNAL* (N = 102)	EXTERNAL (N = 70)	SIGNIFICANCE (P)**
Manage the PBL method	3.8 (1.1)	4.3 (0.8)	0.006
Facilitate small-group functioning	4.2 (0.8)	4.5 (0.8)	0.02
Guide study of specific content	4.0 (1.0)	3.8 (1.1)	0.2
Foster autonomy	4.0 (0.9)	3.9 (1.0)	0.3
Foster humanism	3.7 (1.1)	4.0 (1.0)	0.1
Stimulate motivation	4.2 (0.9)	3.5 (1.2)	0.0002
Assess learning	3.8 (1.0)	3.6 (1.3)	0.3
Participate in academic administration	3.2 (1.0)	2.9 (1.3)	0.06

\* Mean score after unit teaching

\*\* Mann-Whitney test    ( ) = Standard deviation

*Specifying competencies*

Concurrently with validating the task list, we were working to define competencies and behaviors linked to them. Using Davies' model, we needed to specify knowledge, attitudes, and skills required for task accomplishment (Davies, 1973). We made no distinction between generic and specific competencies per task (Segall, 1980); furthermore, we did not consider it necessary to specify the objectives, components, and fields for the knowledge to be covered (Stone, 1987).

At this stage, it was also time to develop criteria for measuring effectiveness in the role of PBL tutor. Awareness of this led to the design of a matrix specifying the behaviors of a tutor who accomplishes her or his tasks competently (Table VI).

Pottinger emphasizes the danger of using a committee of experts to define competencies (Pottinger, 1979). The overriding need to set up a training program nevertheless justified just this procedure.

*Validating the competency list*

In 1988-89, just as we embarked on the second year of implementing the reform, we began a process of having the list of competencies validated by tutors still fresh from their maiden experience. We asked them to rate each of 34 competencies on a scale from 1 to 5, going from *not very useful* to *absolutely useful* for task accomplishment. We thus evaluated the pertinence of these competencies on the basis of 130 answers to our questionnaire.

Results showed that, irrespective of the amount of their experience or the program year for which they acted as tutor, tutors did not change their evaluation. The competencies appeared to be truly fundamental, so that they remained *useful* for each group of students in first or second year, at any rate during an implementation period. There was only one competency, *recognizing when and how to act to foster the learning process*, for which significant differences were observed. Second-year tutors considered this competency *less useful* than first-year tutors. Even with experience under their belts, tutors of first-year units continued to find this competency *more useful*. No difference whatsoever is to be observed between the first and second year of experience as tutors among tutors of first-year units, half of whom remained the same. The difference between tutors of first-year and second-year units can be accounted for by the fact that second-year students have been working with the PBL method for longer and attained greater autonomy in learning.

A comprehensive compilation of average evaluations for 33 of 34 competencies (See Table VII) shows a block of three competencies standing out, with means varying from 4.40 to 4.35. These competencies relate to the tasks of *facilitating small-group functioning*, *guiding study of specific content*, and *assessing learning*. They are rated very close to the score of *absolutely useful* (5 points). This is easy to understand, in light of the fact that their broader content gives them on-going relevance to PBL work.

A difference of 0.07 separates the second group of competencies and the third, which comprises six competencies considered *highly useful*. Their means vary from 3.89 to 3.79. Three of them relate to the task of managing the PBL method. Students take turns leading discussions and thus manage the PBL method. Nevertheless, when students are not doing so satisfactorily, the tutor is called upon to act. In other words, the tutor is ultimately responsible for applying the PBL method. She or he must therefore from time to time exercise the competencies related to the task. Two competencies in this grouping concern the task of assessing learning, and the last one relates to the development of autonomy.

The fourth group of competencies is separated from the third by a difference of 0.06. The fourth comprises nine competencies considered to be *quite useful*, with their evaluation mean varying from 3.73 to 3.61. Two of them concern the task of assessing learning; two, the task of stimulating motivation; and the last two, the task of participating in academic administration.

Last of all, a difference of 0.08 separates the fourth group from the fifth and last, a set of six competencies considered to be *not very useful*. Their means vary from 3.53 to 3.30. These competencies are related to five of the eight tasks. This group consists essentially of competencies at the level of knowledge; indeed, five of them begin with the wording "knowledge of". In contrast, the three competencies judged the most useful are generic and directly tied in with know-how.

A 34th competency, knowledge of the frame of reference for optimal group functioning (St-Arnaud, 1989), received no more than 2.94 on a scale of 5. This competency, least valued of all by tutors, relates to knowledge of an analytical framework and is linked to the task of fostering small-group functioning.

We concluded that tutors were in agreement on the usefulness of the competencies identified by the task force as necessary to the exercise of the tutor role. Their experience enabled them to give a more specific evaluation of each competency's usefulness. Note that 27 of 34 competencies (76%) were classified from *quite useful* to *absolutely useful*. The overall mean of the 34 competencies (3.8) suggests a high level of task usefulness. However, it should not be forgotten that the scale used promotes evaluation at the higher end of usefulness.

At this point, means of all the competencies for each task can be brought together (See Table VIII).

Table VIII presents the tasks in four blocks. The first shows that experienced tutors found the competencies identified by the task force for guiding the study of specific content to be extremely useful. Recall that Sherbrooke chose teachers who were relatively "knowledgeable" in a unit's subject matter as tutors. Tutors found the competencies for

Table VI. Competencies and behaviors linked to the eight tasks of the PBL-tutor role

TASK AND OPERATION DEFINITION	COMPETENCIES	BEHAVIORS
<p><b>MANAGE THE PBL METHOD</b></p> <p>In tutorials, the tutor oversees conscious execution of each of the ten stages in the PBL approach</p>	<ul style="list-style-type: none"><li>• Knowledge of the basic philosophy and attitudes of the PBL method</li><li>• Knowledge of the ten PBL stages, allowing the tutor to verbalize them spontaneously</li><li>• Ability to determine the features of each stage</li><li>• Ability to identify the stage reached by a group as it occurs</li><li>• Ability to assess the execution of each of the ten stages</li><li>• Ability to give the group feedback on its execution of each stage</li></ul>	<ul style="list-style-type: none"><li>• Ensuring students go through each stage and verbalize it</li><li>• Making the group aware that a stage has been completed, that the group is reverting to an early stage, or that they are beginning the next stage</li><li>• Verifying that each stage has been completely executed</li><li>• Describing how the group has executed each stage or some of them</li></ul>
<p><b>FACILITATE SMALL-GROUP FUNCTIONING</b></p> <p>The tutor supports a student in the role of group leader or fills that role at need. The tutor tries to channel group energy as required by the task.</p>	<ul style="list-style-type: none"><li>• Knowledge of St-Arnaud's frame of reference for optimal group functioning (St. Arnaud, 1989)</li><li>• Ability to describe the roles and tasks of a group leader</li><li>• In a group situation, ability to identify the tasks appropriate to the group leader</li><li>• Ability to carry out group-leadership tasks appropriately as needed</li><li>• Ability to recognize the functional problem encountered by a group in difficulty and help the group find a feasible solution.</li></ul>	<ul style="list-style-type: none"><li>• Ensuring that students roles are clearly defined</li><li>• Ensuring that use of time is planned and the plan is respected</li><li>• Helping the students do the same thing at the same time</li><li>• Allowing each student the chance to express herself or himself</li><li>• From time to time, reformulating students' thoughts</li><li>• Fostering the identification of difficulties encountered, naming them in a descriptive way, and helping the group find solutions</li><li>• Ensuring the learning climate allows for trial and error</li><li>• Insisting the group assess its functioning at the end of the meeting</li></ul>
<p><b>GUIDE STUDY OF SPECIFIC CONTENT</b></p> <p>By virtue of his or her efforts, the tutor guides students' learning in the direction of the concepts and mechanisms identified.</p>	<ul style="list-style-type: none"><li>• Knowledge of the concept tree underlying the problems studied</li><li>• Recognition of when and how to act to foster the learning process</li><li>• Knowledge of the various kinds of questions that foster the learning process</li><li>• Ability to make judicious use of open questions</li></ul>	<ul style="list-style-type: none"><li>• Asking open questions at the right moment</li><li>• Periodically reviewing concepts discussed</li><li>• Dealing kindly with students' contributions</li><li>• Situating the group's work in relation to the content to be explored</li><li>• Allowing for and tolerating error without endorsing it</li></ul>
<p><b>FOSTER AUTONOMY</b></p> <p>The tutor sees to it that every tutorial allows for experiencing at least one of the elements of the autonomous learning approach.</p>	<ul style="list-style-type: none"><li>• Knowledge of the elements of the autonomous learning approach</li><li>• Knowledge of the limits and conditions of an autonomous approach</li><li>• Knowledge of how to measure a student's autonomy</li><li>• Knowledge of helping strategies</li></ul>	<ul style="list-style-type: none"><li>• Clearly conveying the importance of learning how to be autonomous</li><li>• Encouraging students to do on their own everything they can</li><li>• Actively supporting, verbally and non-verbally, responsible behavior</li><li>• As necessary, broaching a discussion of the elements of the autonomous approach</li><li>• Ensuring that, at each tutorial, students draw up a plan of study</li><li>• Adjusting one's actions to each student's degree of autonomy</li><li>• Encouraging students' self-evaluation</li></ul>

TASK AND OPERATION DEFINITION	COMPETENCIES	BEHAVIORS
<p><b>FOSTER HUMANISM</b></p> <p>Humanism is expressed through scientific integrity, respect for values, and empathy in relations with others. The tutor sees that a humanistic climate prevails within the group.</p>	<ul style="list-style-type: none"><li>• Knowledge of the conditions for a rigorous analytical approach</li><li>• Ability to respect students' values</li><li>• Concern to develop empathy in relations with others</li><li>• Knowledge of the conditions for active listening</li></ul>	<ul style="list-style-type: none"><li>• Pointing out lack of intellectual rigor in student contributions</li><li>• Making one's own scientific frame of reference explicit and participating in the analytical process</li><li>• Respecting students' opinions and values</li><li>• Bringing students to undertake analysis of a problem's human dimension</li><li>• Occasionally reformulating students' thoughts</li><li>• Using "I" forms for one's comments</li><li>• Verbally conveying one's positive view of students, even during periods of difficulty</li></ul>
<p><b>STIMULATE MOTIVATION</b></p> <p>Motivation, which is a force found within the individual, is the engine that drives the learning process, that is, it launches it, guides it, and allows it to reach its goal. The tutor acts to influence student motivation.</p>	<ul style="list-style-type: none"><li>• Knowledge of the principal motivational theories</li><li>• Ability to identify relevant motivational factors as the situation arises</li><li>• Ability to describe the most effective strategies for influencing student motivation</li></ul>	<ul style="list-style-type: none"><li>• Being concerned with the level of energy students are investing in the learning process</li><li>• Showing enthusiasm and interest for the subject of study</li><li>• Allowing for specific times when students can become aware of the relevance and importance of the subject of study to themselves</li><li>• Accepting that time must be invested in inquiring what difficulties students are encountering with the autonomous approach</li><li>• Adopting facilitating behaviors in the face of student difficulties</li></ul>
<p><b>ASSESS LEARNING</b></p> <p>The tutor assumes the task of measuring students' ability to educate themselves.</p>	<ul style="list-style-type: none"><li>• Knowledge of the principles of measurement and assessment</li><li>• Mastery of the act of assessment while taking into account biases in judgement</li><li>• Understanding of the student-learning assessment system as a whole</li><li>• Knowledge of the specific features of the assessment grid used.</li><li>• Knowledge of how to observe individual students during tutorials</li></ul>	<ul style="list-style-type: none"><li>• At set times, scoring students on their ability to:</li><li>• develop their skill in problem analysis</li><li>• Improve their functioning as autonomous learners</li><li>• increase the quality and effectiveness of their group participation</li><li>• express their sense of humanism</li><li>• Receiving studnts' self-assessments</li><li>• Compiling scores and assigning grades</li></ul>
<p><b>PARTICIPATE IN ACADEMIC ADMINISTRATION</b></p> <p>Acting as an intermediary between students and those responsible for academic coordination, the tutor carries out the management tasks required by the system.</p>	<ul style="list-style-type: none"><li>• Knowledge of the calender of the unit</li><li>• Proper understanding of the unit's place in the program</li><li>• Knowledge of what the system requires of the tutor role</li></ul>	<ul style="list-style-type: none"><li>• Beginning and ending tutorials on time</li><li>• Submitting feedback on the progress of activities to the person responsible for that unit</li><li>• Filling in students' assessment forms appropriately</li><li>• Convey to students management information that concerns them</li><li>• Check students' presence</li></ul>

Table VII. Validation of usefulness of competencies identified in relation to PBL-tutor tasks

COMPETENCIES IN ORDER OF USEFULNESS	MEAN EVALUATION*	STANDARD DEVIATION	TASK **
<b>ABSOLUTELY USEFUL</b> <ul style="list-style-type: none"><li>• Ability to recognize the functional problem encountered by a group in difficulty and help the group find a feasible solution</li><li>• Recognition of when and how to act to foster the learning process</li><li>• Knowledge of how to observe individual students during tutorials</li></ul>	4.40 4.39 4.35	(0.69) (0.65) (0.69)	2 3 7
<b>EXTREMELY USEFUL</b> <ul style="list-style-type: none"><li>• Knowledge of the basic philosophy and attitudes of the PBL method</li><li>• Knowledge of the concept tree underlying the problems studied</li><li>• Ability to respect students's values</li><li>• Ability to make judicious use of open questions</li><li>• Ability to carry out group-leadership tasks appropriately as needed</li><li>• Knowledge of the conditions for active listening</li><li>• Concern to develop empathy in relations with others</li><li>• Knowledge of the various kinds of questions that foster the learning process</li><li>• knowledge of the calender of the unit</li></ul>	4.18 4.17 4.11 4.05 4.00 3.98 3.98  3.97 3.96	(0.88) (0.80) (0.95) (0.83) (0.76) (0.88) (0.93)  (0.77) (0.89)	1 3 5 3 2 5 5  3 8
<b>HIGHLY USEFUL</b> <ul style="list-style-type: none"><li>• Ability to identify the stage reached by a group as it occurs</li><li>• Knowledge of helping strategies that foster an autonomous approach</li><li>• Ability to determine the features of each stage</li><li>• Knowledge of the specific features of the assessment grid used</li><li>• Ability to give the group feedback on its execution of each stage</li><li>• Mastery of the act of assessment while taking into account biases in judgement</li></ul>	3.89 3.83 3.81 3.81 3.79  3.79	(0.79) (0.87) (0.79) (0.90) (0.90)  (0.87)	1 4 1 7 1  7
<b>QUITE USEFUL</b> <ul style="list-style-type: none"><li>• Knowledge of the principles of measurement and assessment</li><li>• In a group situation, ability to identify the tasks appropriate to the group leader</li><li>• Understanding of the student-learning assessment system as a whole</li><li>• Ability to describe the most effective strategies for influencing student motivation</li><li>• Knowledge of what the system requires of the tutor role</li><li>• Ability to assess th execution of each of the ten PBL stages</li><li>• Ability to identify relevant motivational factors as the situation arises</li><li>• Proper understanding of the unit's place in the program</li><li>• Knowledge of how to measure a student's autonomy</li></ul>	3.73  3.72 3.72  3.72 3.71 3.69 3.64 3.62 3.61	(0.82)  (0.78) (0.76)  (0.92) (0.78) (1.17) (0.87) (0.84) (0.98)	7  2 7  6 8 1 6 8 4
<b>NOT VERY USEFUL</b> <ul style="list-style-type: none"><li>• Ability to describe the roles and tasks of a group leader</li><li>• Knowledge of the elements of the autonomous learning approach</li><li>• Knowledge of the limits and conditions of an autonomous learning approach</li><li>• Knowledge of the conditions for a rigorous analytical approach</li><li>• Knowledge of the ten PBL stages, allowing the tutor to verbalize them spontaneously</li><li>• Knowledge of the principal motivational theories</li></ul>	3.53 3.52  3.50 3.50  3.37 3.30	(0.81) (0.83)  (0.87) (0.98)  (1.11) (0.93)	2 4  4 5  1 6

\* Scale of 1 (not very useful) to 5 (absolutely useful).  
\*\* 1) Manage the PBL method; 2) facilitate small-group functioning; 3) guide study of specific content; 4) foster autonomy; 5) foster humanism; 6) stimulate motivation; 7) assess learning; 8) participate in academic administartion.

fostering humanism and assessing learning highly useful. They found those related to managing the PBL method, participating in academic administration, and facilitating small-group functioning quite useful. Last, tutors considered that the competencies identified as required for two of the tasks, fostering autonomy and stimulating motivation, were no more than useful. Students admitted to this heavily oversubscribed program are highly motivated; probably, therefore, teachers see less need to stimulate their motivation.

The procedures for validating the lists of tasks and competencies were very valuable in guiding tutor training. Let us compare the data in Table X with those of the internal validation procedure. The tasks of fostering autonomy and stimulating motivation were viewed as important (scoring from 4.1 to 4.3) at the time of the validation process. Yet the competencies related to them are considered to be the least useful. These results do not mean that tutors assign little value to what the tasks represent. They may however suggest that the competencies linked to them are not very useful, that the training activities were not very effective in prompting their acquisition, or that their own mastery proved too weak. At all events, it was clear that work needed to be done in relation to these tasks. Information of prime importance had thus been made available to training planners.

Table VIII: Mean scores for usefulness of competencies identified for PBL-tutor task

Task and related competencies	Mean*	Standard deviation	Degree of usefulness
• GUIDE STUDY OF SPECIFIC CONTENT (4 competencies)	4.15	(0.56)	Extremely useful
• FOSTER HUMANISM (4 COMPETENCIES)	3.90	(0.77)	Highly useful
• ASSESS LEARNING (5 competencies)	3.89	(0.67)	Highly useful
• MANAGE THE PBL METHOD (6 competencies)	3.87	(0.64)	Quite useful
• PARTICIPATE IN ACADEMIC ADMINISTRATION (3 competencies)	3.75	(0.69)	Quite useful
• FACILITATE SMALL-GROUP FUNCTIONING (5 competencies)	3.73	(0.57)	Quite useful
• FOSTER AUTONOMY (4 competencies)	3.6	(0.78)	No more than useful
• STIMULATE MOTIVATION (3 competencies)	3.55	(0.80)	No more than useful

\* Highest score: 5. Based on 130 answer sheets.

In summary, when experienced tutors were asked to evaluate the usefulness of the 34 competencies listed as being required for the tutor role, we learned that:

- No significant difference in evaluation was discerned among first-year tutors, whether they were filling the role for the second or third time, or between first-year and second-year tutors, except regarding the ability to recognize when and how to act to foster the learning process.
- In classifying all competencies according to their degree of usefulness, five groupings emerged: nearly absolutely useful, extremely useful, highly useful, quite useful, and no more than useful.
- In linking competencies to the tasks they are related to, we observed that tutors evaluated competencies identified for guiding the study of specific content as extremely useful, whereas those for fostering autonomy and stimulating motivation were considered no more than useful. Falling between these two groupings, competencies related to other tasks scored means of usefulness ranging between highly useful and quite useful.
- With this experience under their belts, tutors suggested several other competencies which were to influence subsequent training programs.

### *Establishing Training Objectives*

Our tutor-training system was founded on the identification of tasks and competencies needed to be an effective tutor. It was important to validate them, therefore, since they were to serve as the foundations of the training program, and since each teacher was viewed as a novice in the role of PBL tutor. Thus the six first tasks were assigned priority, whereas it was felt that the tasks of assessing learning and participating in academic administration could be covered by the contents of weekly tutor meetings during the course of a unit. Within the list of competencies relating to the six priority tasks, some were assigned greater importance, whether because they were of a fundamental nature or because of the breadth of their application.

The system gained in richness as time went on. It became more complex, and tutors' experience came gradually to be integrated into a process of continuing education, as an essential component (Fig. 1).

### *Carrying out Training Activities*

The first version of the tutor-training workshop took place over two days at the end of summer 1987. This workshop was subsequently repeated because there was significant recruitment of new tutors each year.

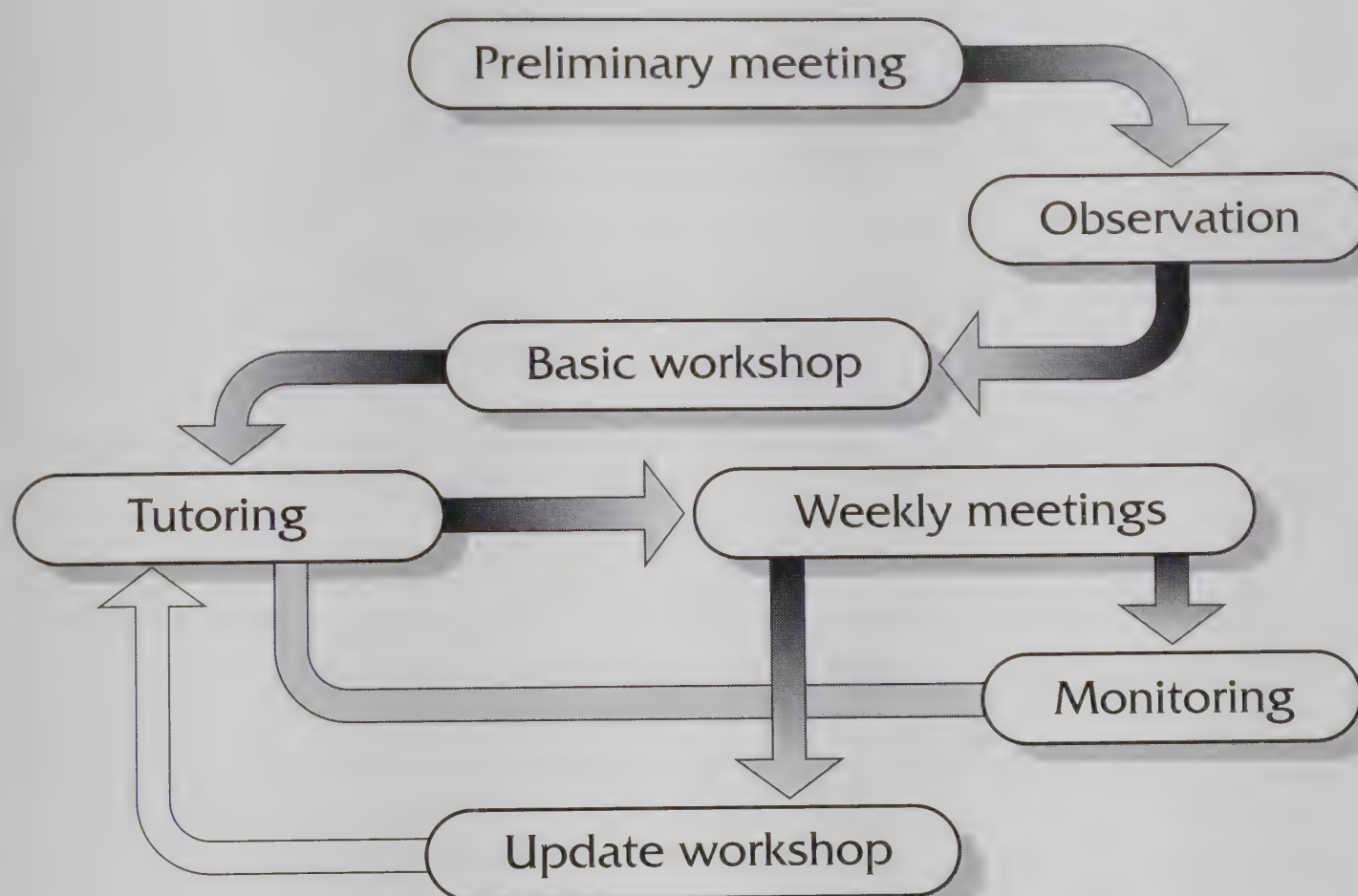


Figure 1. Comprehensive continuous tutor training

#### *Preliminary meeting*

The training process began with a preliminary meeting lasting an hour-and-a-half. Participants were called upon to acquaint themselves with the tutor role as a whole; that is, the tasks, competencies, and behaviors it entails. During the observation period, they were asked to evaluate themselves in relation to each competency, using a self-diagnosis grid, and specify their personal learning objectives.

This meeting took place a few weeks before the training workshop. The training system as a whole was briefly presented (Fig. 1) and the spirit in which we were asking people to participate was discussed. We stressed the perspective of continuing education, each tutor's responsibility for his or her own training and upgrading, the gradual acquisition of the necessary competencies, and the value accorded to experiential learning.

Following the introduction, discussion in groups of three allowed each professor to answer the twofold question, "According to you, what does the work of the tutor consist of and what must one do to carry it out?" The pooling of answers produced a descriptive table of the role. The eight tasks related to the role formed a grid within which to organize the various components suggested by participants, and the whole was compared with a standard portrait of a tutor as defined by the Faculty of Medicine.

Next, each participant filled out the self-diagnosis grid in two copies (Annex 1). As well, everyone was asked to specify what degree of mastery they hoped to attain by the end of the two-day basic workshop. Those managing the meeting took in one copy of these answers, while participants kept the other, to be used to define personal learning objectives.

The usefulness of the grid was tested under four headings: it fostered professors' individual responsibility for their own training as tutors; it showed up their degree of motivation in relation to the different learning objectives and the competencies to be mastered; it supplied an indication of level of learning and sense of mastery for each competency; and it contributed to the planning of the upgrading workshops that were down the road by showing what competencies they wished to improve further at the end of the training workshop.

Designed in the first instance to help tutors get fully involved in their own training, the self-diagnosis grid helped them become familiar with the full set of tasks and associated competencies of the tutor role. Those running training also saw to it that all participants had an opportunity to grasp the internal consistency of the training system as a whole.

The last item on the agenda of the preliminary meeting consisted of preparing the observation activity required prior to the workshop. Everyone was asked to observe every PBL stage using a form designed to prepare for observation.

In its turn, the observation period covered three objectives: each teacher was to become familiar with the reality of problem-based learning at each of its ten stages; each would also observe a tutor in action, paying particularly close attention to the performance of certain tasks or competencies determined on beforehand; and each would identify questions and information and training needs that the workshop would seek to respond to.

The meeting ended with the distribution of a text designed to help participants gain a deeper knowledge of observation-period objectives (Delorme et al., 1987).

### *Basic tutor training*

The basic training workshop enabled the participants to achieve these objectives:

- review and supplement the basic notions of the PBL method;
  - acquire concepts for analyzing tutorial situations;
  - master certain competencies useful in the accomplishment of the first six specific tasks of the tutor role:
    - manage the PBL method,
    - facilitate small-group functioning,
    - guide study of specific content,
    - foster autonomy,
    - foster humanism,
    - stimulate motivation.
-

Table IX. Plan of PBL basic training workshop

SCHEDULE, DURATION, OBJECTIVES	ACTIVITY DESCRIPTION
Day 1- Morning Approximately 1 hour and 30 minutes	<p>THE WORKSHOP GETS GOING</p> <ul style="list-style-type: none"><li>- Word of welcome</li><li>- Links to the preliminary meeting and the observation period.</li><li>- The program's major components.</li><li>- Introduction of resource people.</li><li>- Workshop objectives.</li><li>- Plan for progress of workshop based on self-diagnosis.</li></ul> <p>Individual written work for 5 minutes:</p> <ul style="list-style-type: none"><li>- What are my fears or the difficulties I anticipate with the work of a tutor?</li><li>- What is not clear to me about this role?</li></ul> <ul style="list-style-type: none"><li>- Plenary on fears, difficulties, questions.</li><li>- Links to different components of the workshop where concerns raised by participants can be addressed.</li></ul>
Approximately 2 hours <ul style="list-style-type: none"><li>- Identify the 10 PBL stages and be able to verbalize them spontaneously.</li><li>- Recognize the features of each stage.</li><li>- Visualize certain tutor actions useful in promoting effectiveness at each stage.</li><li>- Become aware of the art of asking useful questions for optimizing learning.</li></ul>	<p>PBL-TUTOR ACTION</p> <ul style="list-style-type: none"><li>- Review of the eight tutor tasks.</li><li>- Presentation of a video and explanation for each task.</li><li>- Screening for each PBL stage. Question: What tutor actions might be useful at this stage?</li><li>- Placement of suggestions on the grid of tutor tasks and behaviors.</li><li>- Note open-ended and closed questions during the discussion.</li><li>- Sift out the content important to retain for effective action at each stage.</li><li>- Close this activity by going back to the objectives and seeing whether they have been reached.</li><li>- Hand out the document called</li></ul>
Afternoon  Approximately 3 hours <ul style="list-style-type: none"><li>- Acquire some notions of the theory of group psychology and group leadership.</li><li>- Learn to note the constituents of a group and of learning-group leadership.</li><li>- Develop competency in group</li></ul>	<p>FACILITATING SMALL-GROUP FUNCTIONING</p> <ul style="list-style-type: none"><li>- Identification of constituent elements in group functioning. Each participant individually identifies what makes a group function or fail to function, based on his or her own experience.</li><li>- Pooling and writing up on the board of observations. Synthesis: some theoretical concepts about groups and group leadership. (St. Arnaud, 1989)</li><li>- Practice in group leadership and in observation of group functioning.<ul style="list-style-type: none"><li>• Task explained to observers and observation grid distributed.</li><li>• Task explained to participants and distribution of "Claude's Problem".</li><li>• Approximately 20 minutes of discussion to help solve the problem.</li></ul></li><li>- Review of group experience and feedback on group functioning and leadership in light of group's constituent elements.</li><li>- Role reversal; identical procedure followed.</li><li>- Homework handed out: chapter on motivation. (Jean et al., 1993)</li></ul>

\* *Claude's problem*

Dear colleagues: I have run into a problem with one of my students. Can you help me? Claude came to me as his sponsor and announced that he is not sure he wants to continue his studies; and yet the last time my group met, two weeks ago, all four students were working hard and were very enthusiastic. Claude was falling a bit behind because he reads English slowly; nevertheless, he was full of his plans as a future physician.

Last week, he sat the Faculty's first formative exam in immunology. The exam was designed to be very hard in order to stimulate students to learn more. Claude, who has always come first, got poor results: a D. Since then he has been distracted and makes no progress in his work. He is wondering whether he is capable of medical studies. His tutor told him not to worry about it, because formative examinations "do not count". He tells me he has lost his enthusiasm.

Can you help me understand Claude's problem? How can I help him? Unfortunately, I can not be present at your meeting, but I will discuss it with you when I come back from my vacation. Thank you very much.

A colleague in distress

<p>Day 2- Morning Approximately 15 minutes</p> <p>Approximately 1 hour and 15 minutes</p> <ul style="list-style-type: none"><li>- Identify factors that may motivate or demotivate students in PBL.</li><li>- Become familiar with some motivational theories.</li><li>- Identify tutor behaviors likely to optimize student motivation.</li></ul> <p>Approximately 2 hours</p> <ul style="list-style-type: none"><li>- Try out the tutor role and take part in a tutorial in action.</li><li>- Observe a tutor in action and identify useful and useless actions in relation to the four tasks already studied.</li><li>- Discuss the role of tutor with students.</li></ul>	<p>WELCOME</p> <p>Review of initial questions formulated the evening before and contents of the day. Discussion in plenary: What answers or partial answers have I received and what remains to be clarified?</p> <p>FOSTERING MOTIVATION</p> <ul style="list-style-type: none"><li>- Presentation of objectives and explanation of the task:<ul style="list-style-type: none"><li>• Individually or in small groups of two or three participants identify factors in the PBL method that could motivate or demotivate students.</li></ul></li><li>- Plenary on factors related to the method.</li><li>- Synthesis: some notions of motivational theory.<ul style="list-style-type: none"><li>• Small-group work: identify possible actions the tutor can take to stimulate student motivation.</li></ul></li><li>- Plenary on effective tutor behaviors for stimulating motivation.</li></ul> <p>TRYING OUT A TUTORIAL</p> <ul style="list-style-type: none"><li>- Presentation of students' tasks:<ul style="list-style-type: none"><li>• In executing PBL stages 1 to 5, identify learning objectives related to a problem.</li><li>• Begin stage 9: small-group self-assessment.</li></ul></li><li>- Presentation of teachers' tasks:<ul style="list-style-type: none"><li>• Observation of a tutorial in action.*</li><li>• As called upon by workshop leaders, fill the role of a PBL tutor for about 10 minutes.</li></ul></li><li>- Tutorial exercise.</li><li>- Review in plenary:<ul style="list-style-type: none"><li>• Continuation in plenary of self-assessment begun in small groups, mainly on tutor actions.</li><li>• Review of situations experienced and observed at every stage; discussion with students.</li></ul></li><li>- Lunch with the students; students leave.</li></ul>
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\* Using observation grids (Annex 2).

Afternoon 30 minutes	Review of the tutor role in light of the morning's experience.
About 1 hour and 15 minutes	<p>FOSTERING HUMANISM: EMPATHY AND ACTIVE LISTENING</p> <ul style="list-style-type: none"><li>- Individual reflection to recall situations where someone called on me for help in resolving a difficulty.<ul style="list-style-type: none"><li>• Brief discussion of what can be done in similar circumstances.</li></ul></li><li>- Synthesis: some notions about empathy and active listening, with examples of what they are and what they are not.</li><li>- Role playing: before the group, one person plays the role of someone who, in the past, has asked him or her for help resolving a difficulty, and another person tries to help him or her by implementing the conditions of active listening.</li><li>- Review of what was experienced and observed, in light of the theory provided.</li></ul> <p>A second and if possible a third role play are conducted, each one to be followed by a review of the experience.</p>
Approximately 1 hour	<p>FOSTERING AUTONOMY</p> <ul style="list-style-type: none"><li>- Individual reflection in small groups: What indications may be observed to show that students are autonomous?<ul style="list-style-type: none"><li>• Pooling of indications (recorded on the board).</li></ul></li><li>- Synthesis: the concept of autonomy and its main indicators.</li><li>- How to devise one's own observation grid o better measure autonomy</li><li>- Group discussion: How can te program and tutors foster learning and autonomy in students?</li></ul>
Approximately 45 minutes	<p>WORKSHOP CONCLUSION</p> <ul style="list-style-type: none"><li>- Questionnaire for validating tutor-role task list.</li><li>- Self-diagnosis grid on mastery of tutor-role competencies.</li><li>- Workshop-evaluation questionnaire.<ul style="list-style-type: none"><li>• Important conclusions to retain and oral evaluation of the workshop.</li></ul></li><li>- Screening of some sequences from the Maastricht video (Schmidt) and discussion of possible solutions to difficulties presented.</li></ul>

The plan of the workshop was designed to preserve a degree of flexibility. The framework for its contents ensured consistency in tutor training from one workshop to another (Table IX). The first time the basic training workshop was offered, in August 1987, it took place scarcely a week before the first cohort of students arrived! Verbal evaluations and the written questionnaires participants filled out at the end of each workshop vastly improved the unfolding of subsequent training workshops.

*Upgrading*

Right from the first year a review of the training program led to the conclusion that tutors' training needed to be supplemented with upgrading workshops. From the second year in which the tutor role was implemented, all unit tutors were invited to take part in an upgrading workshop lasting a day or half a day. The themes discussed (Table X) were determined on the basis of tutorial observation,

comments made during tutors' meetings, comments by student representatives, new institutional needs, the self-diagnosis grids, and program evaluations conducted at the end of each academic year.

What were the orientations of tutor continuing education to be? Those managing the process planned for it to progress from the general to the specific. At the start, training workshops brought together tutors from two or three different units. As time went by, they became more and more specifically adapted to the needs of a single unit. Enhanced consistency between the content to be covered, the quality of problems, the teaching environment (formative assessments, supplementary teaching activities, and so on), and final assessment made this necessary. An increase in feelings of group membership, the desire to excel, and closeness and loyalty among tutors contributed to the adoption of this approach. Our goal in developing the upgrading program was to better meet tutors' needs. The system of facilitators and personal instructions were devised as ways of individualizing the training system designed for them.

## Evaluation of the Training Program

Evaluating a training program presupposes the gradual putting into place of diverse methods and cooperation by all (Davies, 1973). We continued to promote interaction between the training program and participants' perceptions about their own needs and learning. The instrument of choice remained the self-diagnosis grid (Annex 1), which conveys a tutor's personal view of his or her own competencies without confronting it with either student or observer opinions. A tutor's true competencies, as manifested in daily behavior, remained unknown. Nevertheless, by analyzing the differences between individual evaluations, before and after workshops, of their current and desired competency levels, we obtained indicators of motivation to learn, the feeling of having learned, and the desire to continue learning.

### *Indicators of the motivation to learn*

From one workshop to another, there were changes in the significance assigned to specific activities. The criterion used to bring in a change remained the difference between current and desired level of competency. For example, Table XI presents the data obtained on the tasks of managing the PBL method and fostering humanism in the meeting preliminary to the training workshop held on January 25, 1989.

Table XI shows the sum of the differences between current and desired level at the workshop's conclusion. The second column shows the maximum possible difference based on the number of respondents (the result that would have been obtained if all had scored 1 for their current level and 5 for their desired level). The percentages shown in the third column of figures represent the difference between perceived difference and

maximum difference and show the degree of improvement needed or the degree of desire for improvement. For example, the desire to learn (73%) for the competency "Can assess execution of each of the 10 PBL stages" (Table XI, item 1.5) is greater than that for respect for students' values (28%) (Table XI, item 5.2).

When we were preparing workshops, these data helped us verify the suitability of the planned framework. For instance, we decided to devote more time to the task of managing the PBL method, since learning related to this task elicited a 63.7% desire for improvement, whereas the figure for the task of fostering humanism was only 38.4%. Data of this kind increased participants' awareness of the group's level of motivation and helped them take responsibility for their own training needs. Nevertheless, self-diagnosis could only serve as an indication, because teachers at the preliminary stage of training do not yet know the exact content associated with each competency.

In 1988-89, the results obtained by compiling the self-diagnosis grids were used in double-checking the choice of activities for each of the workshop's five presentations. Some activities needed to be reorganized to better satisfy teachers' needs and their motivation to learn. That year, therefore, we assigned less time to the activity relating to knowledge of various kinds of questions and practice in asking open-ended questions, assigning instead more time to the acquisition of competencies related to managing the PBL method.

#### *Indicators of learning accomplished*

Since it is administered both before and after a workshop, the training self-diagnosis grid serves as an indicator of the workshop's effectiveness. It reveals how far participants perceive they have progressed in mastering the competencies required for their tasks. The greater the average difference between perception of the level of mastery before the workshop and after it, the greater the perception of learning accomplished. Thus, in Table XII, it can be observed that for 1988-89, compilation of 54 grids revealed significant differences in relation to the first six tasks:

- Learning accomplished is greater for competencies related to the task of managing the PBL method. This is consistent with indicators of motivation and reworking of the program.
- These future tutors focused their learning above all on the tasks of facilitating small-group functioning and stimulating motivation.
- For the task of fostering autonomy there was an increase in relevant competencies.
- A detailed analysis around the task of guiding study of specific content showed that mastery of three of the four relevant competencies slightly increased, while competency in knowledge of various kinds of questions that foster learning showed significant progress.
- Tutors found they only slightly increased their mastery of competencies in the task of fostering humanism.

Table X. Themes of the upgrading workshops

THEME	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
Review of experience	✓	✓	✓	✓	✓	✓
A message from the Program Administration	✓	✓	✓	✓	✓	✓
Descriptive feedback (theory + practice)	✓		✓			
Humanism	✓					
Improvement in PBL steps	4,5,7		7,9	4,7,9		
Student assessment by tutors	New grid validated	New grid standardized		✓		
Organization of knowledge					✓	✓
Small-group functioning		Exercises Observation Discussion		The first tutorial		
Final fine-tuning of the unit by tutors			✓	✓	✓	

Table XI. Indicators of motivation to learn difference between current level and level desired before the workshop

		FOR THE GROUP AS A WHOLE		
TASK	COMPETENCIES	Difference between current/desired level	Maximum possible difference*	%
Manage the PBL method	1.1 Know the philosophy...	32	68	47.2%
	1.2 Know the 10 stages...	45	68	66.2%
	1.3 Can determine features...	44	68	64.9%
	1.4 Can identify the stage...	46	68	67.9%
	1.5 Can assess execution...	44	60**	73.0%
	1.6 Can supply feedback...	44	68	64.9%
	SUBTOTAL	255	400	63.7%
Foster humanism	5.1 Know the conditions...	35	64	55.0%
	5.2 Can respect...	18	64	28.0%
	5.3 Am concerned to develop...	20	68	29.3%
	5.4 Know the conditions for...	27	64	42.2%
	SUBTOTAL	100	260	38.4%

\* If everyone scored 1 for current level and 5 for desired level (N: 17 participants).  
\*\* One or two participants did not provide answers for one or the other of the competencies.

The final two tasks showed no statistically significant results, and for good reason: competencies related to them had not been incorporated into workshop objectives. They were reserved for a more opportune time. These results tend to confirm the sensitivity of the instrument of measurement.

*Indicators of the desire to continue learning*

Upon analysis of the results on self-diagnosis grids filled out at the end of the workshop, regarding the difference between mastery level attained and desired, another indicator, that of desire to continue learning, revealed a desire for further training in competencies for all eight tutor tasks. Only two specific competencies continued to reach an average difference of more than two points; in contrast, two weeks before the workshop, ten competencies yielded this indicator of motivation.

Table XII. Indicators of learning accomplished in the five workshops held in 1988-1989

TASK	Average (mastery of competency)		Average difference  (learning accomplished)	Significance*
	Pre-workshop	Post-workshop		
Manage the PBL method	2.40 (1.1)	3.86 (0.8)	1.46 (1.3)	S
Facilitate small-group functioning	1.94 (1.0)	2.96 (0.8)	1.02 (1.1)	S
Guide study of specific content	2.62 (1.1)	3.44 (1.0)	0.82 (1.1)	S
Foster autonomy	2.24 (0.9)	3.23 (0.9)	0.99 (0.9)	S
Foster humanism	3.30 (1.1)	3.78 (0.9)	0.48 (1.1)	S
Stimulate motivation	2.28 (1.1)	3.30 (0.9)	1.02 (1.1)	S
Assess learning	2.34 (1.0)	2.60 (1.0)	0.25 (1.0)	NS
Participate in academic administration	2.70 (1.4)	2.90 (1.3)	0.20 (1.5)	NS

\* Matched T test                      ( ) = Standard deviation

These two competencies relate to the task of assessing learning. It becomes clear why the first two versions of the upgrading workshop included assessment (Table X, theme 6). For the task of managing the PBL method, only one competency continued to show a motivation level higher than 1 point following the workshop. This was the ability to provide feedback to the group on how it has executed each stage. Thus this competency became a learning objective to help tutors in the first edition of the upgrading workshop (Table X, theme 3). The same applied to the three competencies related to the task of facilitating small-group functioning (average difference of more than 1 point). In order to increase tutors' ability to help the student group leader, concepts related to optimal group functioning were illustrated and put in practice through group-leadership exercises.

Examination of averages for all the competencies related to each task shows that significant learning needs to be persisted at the end of the workshop for the last two tasks. It should be recalled that the workshop's objectives did not include these two tasks. Moreover, stimulating motivation and fostering autonomy prompted a desire for further study among tutors. The importance of the task of guiding study of specific content also

led to a sense of needing more training. For the task of facilitating small-group functioning, tutors felt the need for a little more theory and practice. They considered themselves relatively well equipped to manage the PBL method and foster humanism.

Tutors' process of training and upgrading had now passed through enough stages to require revision and adjustment. We had reached a point where we needed to establish criteria for measuring and assessing competencies, without abandoning the perspective of continuing education. This operation represented the next challenge to face if we wished to be assured of a large number of effective tutors.

## The Main Thrusts

### *The importance of the tutor role*

At Sherbrooke we assigned great importance to the development and implementation of a consistent on-going tutor-training system. This investment of time, money, and energy was justified by our certainty that tutor quality would be instrumental to the success of the teaching reform. Gijsselaers & Schmidt had determined there was a significant relation between the tutor role and group functioning (Gijsselaers et al., 1990).

In a paper on the instrument of measurement used at Sherbrooke to evaluate the first-year curriculum, Schmidt et al. showed that students' evaluation of tutors' activities is linked to the students' perception of group functioning, problem quality, and stimulation to study, no matter what the objectives directly presented by the problem (Schmidt et al., 1989a).

Barrows, for his part, considers the tutor to be the cornerstone of the PBL method (Barrows, 1988). Moust et al. use the words "key actor (Moust et al., 1990)". The tutor's prevailing influence on the PBL process can thus be seen to be widely acknowledged. Our own experience confirmed this. In the student evaluations turned in at the end of each PBL unit, it was clear that a positive evaluation of the tutor mitigated, and sometimes in fact wholly overrode, negative perceptions resulting from problem quality or negative components in the learning environment.

### *Becoming centered on learning and on the student*

Tutors were the pillars of the new system when it was implemented. The reform required the greatest effort from them. They were accustomed to the traditional role of a university professor, whose teaching is sound, cannot be challenged, and is presented *ex cathedra*. All, not just those who volunteered, were called upon to submit to the requirements of problem-based learning.

PBL, which is centered on self-directed learning rather than on teaching, obliged teachers-turned-tutors to undergo a difficult process. Teaching-development activities had already

alerted them to the relevant concerns, but now they faced a pressing and incontrovertible requirement to carry out the tasks, master the competencies, and adopt the behaviors of effective tutors.

From the outset, program management had chosen as the goal of the program allowing professors (who had traditionally focused on subject matter or themselves, their research, their clinical practice, and so on) to acquire the competencies of a tutor focused on the student and on learning. This is the perspective of curricula that use the PBL method. For example, as Moust et al. write:

The heart of the tutor-role is his changed perspective on the teaching-learning process. Instead of autonomously transmitting information on the subject-matter on hand and directing what and how the students should learn, the Maastricht tutor has to act as a guide....Students should become self-directed learners who feel responsible for their own learning (Moust et al., 1990).

Rogers has described at length the way the student becomes the main architect of his or her own learning and the role of teacher consists of facilitating the learning process in the group of students (Rogers, 1969). Fostering autonomy, enabling personal responsibility, stimulating motivation, respecting the values of others, developing empathy, are all concerns that recurred throughout the scholarly literature on the humanistic approach, even before they appeared in the model of the tutor role. And yet the undertaking to transform teachers' attitudes and behaviors and steer them in this direction proved arduous.

The validation of the list of tutors' tasks taught us, however, that tutors at Sherbrooke considered their most important tasks to be stimulating the students' motivation to learn and facilitating small-group functioning. They also assigned importance to fostering student autonomy. These results prompted the hypothesis that our professors were ready to learn to focus on students.

#### *Periodic or continuing education*

From the outset Sherbrooke chose to treat tutor training as a continuing-education project. The objective was to provide for tutors' training and personal development by allowing them to gradually acquire the knowledge, competencies, and behaviors needed to fill their role. Faced with a student-centered MD program whose goal is to foster in students autonomous and humanistic attitudes focused on community needs, tutors see a great deal of work rise up before them. They must attain the competency needed for students to achieve these goals while maintaining sound problem-based medical studies.

In assigning importance to the holistic development of the tutor as an individual, we owe an acknowledged debt to what took place at the University of California at Davis (Lanphear & Cardiff) (Lanphear et al., 1987). Berquist & Phillips believe that an effective tutor-

training program often touches professors at the level of their objectives, their values, their personal growth, their interpersonal skills, and even their career planning.

In our view, periodic training activities suit the scope of the change in attitude desired: that of turning professors into student-centered educators. Our tutor-training system offers varied activities and provides opportunities for reaching all of an individual's dimensions. Training workshops, observation, experience, meetings, facilitation, feedback, and upgrading workshops are all represented in the range of educational approaches currently used. At Sherbrooke, the training program is presented as a continuing process right from the preliminary meeting.

#### *A competency-based program*

Our educational model is comprised of interlinked components that form a consistent whole, which we intend to be neither rigid nor linear. The competencies we have identified as necessary to the tutor flow from the tasks assigned to him or her and are associated with behaviors that demonstrate the competent tutor's mastery of the process.

Since the tasks and competencies required for the tutor role were identified so they could serve as the basis for the program of continuing tutor education, it was necessary to validate them as components of our educational model. The average scores obtained for the eight tasks in the process of internal validation all fell higher than 3 on a scale of 5. Each new training activity was designed with specific objectives drawn directly from the data bank of tasks and competencies.

The model was kept very open in regard to the behaviors required of tutors. As the experiment unfolded, training and upgrading workshops offered opportunities to fine tune instructions about putting competencies into practice with specific behaviors. When implementation had begun, tutors were asked to observe rather than intervene; that is, to remain unobtrusive in order to allow students to take responsibility for the process. Nowadays our tutors are more active and make more use of open questions.

The model implemented at Ben Gurion University is premised on close links among the components of the system of education and provides for a sequencing of objectives (Benor & Mahler, 1989). The logic and consistency of such a system entail a predetermined path going from the generic to the specific (Segall, 1980), i.e., from institutional philosophy to the mastery of skills, and addressing tutors' attitudes and motivation in the process.

At Sherbrooke, too, we designed a tutor-training program whose unfolding was determined by a consistent internal logic and sequencing in the educational process. The thread that ran through the whole process was the gradual acquisition of competencies. The process was influenced by the way the new PBL program developed, feedback from student evaluations, end-of-year evaluations, the results of observation, and the sharing of

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experiences. We chose to remain flexible and open in order to adjust to developments within the process of implementing a new MD program.

*Persisting concerns with the content to be covered*

The difficulty of changing from a content-centered to a learning- and student-centered attitude continued to be great. PBL tutors, at any rate at Sherbrooke, always seemed to stay relatively focused on covering the medical content targeted by problems, since the content is a feature common to both teaching and learning. In traditional curricula, content is highlighted, and there is pressure from the biomedical world to assign an ever-greater place to it. Within a PBL program, content, which tutors can rapidly master, constitutes a way of feeling useful, on top of things, and competent. And yet tutors must insist on discussion and on the correctness of concepts. Their contributions should be limited to obtaining explanations, bringing about completion, questioning, supplying clinical examples, checking whether the concept tree has been fully covered, and fostering assimilation of the basic sciences and mastery of the mechanisms of physiopathology.

In the first workshops, almost all tutors, whether they taught first- or second-year units, wanted to discuss content coverage. When the time came to validate the list of competencies, that is, just before they embarked on a second or third experience as tutors, the four competencies linked to the task of guiding study of specific content were scored at the highest level of usefulness. Among the competencies ranked as most useful were knowledge of the concept tree underlying the problems studied and recognizing when and how to act to foster the learning process. It seemed reasonable to hypothesize that the significance assigned to content prompted this perception of the usefulness of the competencies linked to the task of guiding content study.

The problem associated with expert versus facilitator tutors flowed from the significance assigned to content coverage. It would seem that tutors tend to magnify the importance of being experts in the field under study. Their habit of covering specific content and the importance they assign to it results in a strong urge to take this approach and greatly limits their interest in other aspects of their role. Yet, after having shown the cause and effect relation between tutor skills in work with small groups and small-group functioning, Gijsselaers & Schmidt (1990) comment, "Therefore, tutors should be trained on aspects of group dynamics".

Many tutors tended to ask for upgrading workshops to assign less significance to process and address medical-content competencies more extensively. Others said that continuing education specific to each unit constituted an excellent way to achieve harmony between properly applied methods and properly formulated content. Very few expressed the need to better develop their skills at observing and acting appropriately to further small-group functioning. Overall, tutors had the feeling they understood small-group functioning and small-group leadership well enough and considered that time spent on this subject was

poorly invested. What they wanted was to enhance their skills at facilitating students' subject-matter comprehension and learning.

In sum, a continuing-education program based on the acquisition of general and specific competencies appears to be an approach consistent with the educational philosophy underlying PBL.

## Lessons Drawn from Experience

Schmidt et al., 1989b; Benor & Mahler, 1989; and Moust et al., 1990 have studied changes and teacher reactions following training workshops. At Sherbrooke we were aware that teachers were sometimes surprised or disappointed by our training program. They were surprised at not being able to quickly acquire specific skills, and disappointed at not having enough time to devote to the discovery and patient mastery of the art of fostering learning. "What are the best recipes for success? There are not 101 different ways to do a knee arthroscopy or make a good slide. The same thing must go for being a tutor". Teachers were inclined to view it as temporizing when nuanced answers were given that clarified guiding principles and referred tutors to their own judgement about a teaching situation, and thus invoked the relative rather than the absolute and the construction of pedagogical competency rather than ready-made recipes.

Hearing a subject talked about and carrying out some awareness-raising exercises is not enough to enable a person to incorporate a new attitude and adjust his or her behaviors accordingly. This goes for the mastery of certain skills related to small-group facilitation, humanism, student motivation, fostering learning, and fostering autonomy. And yet, tutors had the impression they were wasting time on unimportant or vague subjects.

Nevertheless, the evaluation questionnaires they filled in at the end of each educational activity showed that the great majority much enjoyed the workshop. Analysis of the self-diagnosis grids showed that the gap between the level participants wished to reach and the level they had attained at the end of the workshop was very slender. We took this as confirmation of the satisfaction they expressed in their evaluation sheets. The level of mastery of the competencies related to the six tasks addressed in this workshop increased significantly.

We also observed a very high satisfaction rate at the end of the upgrading workshops that took place at the beginning of each unit. Tutors responded with positive evaluations to renewing and increasing the knowledge, attitudes, and know-how that would help them in playing their role. They appreciated the instructions that were conveyed to them each year to harmonize the program's unfolding and ensure that needed progress and change took place.

All these data led us to believe that the program of continuing tutor education was a useful and welcome instrument despite its imperfections.

But with the approaching end of the PBL program's implementation stage, the time had come to think about how to consolidate gains and passing the baton. At the time implementation was begun, the newness and scope of the change were reason enough to take part in tutor-training workshops. When the time for consolidation arrived, it seemed that in the search for excellence the next major objective should be to enhance the program's teaching quality. Given this framework for reflection and action, tutors' continuing education taken in its fullest sense would go on playing an indispensable role.

One of the sources of information most valued by those responsible for teaching development when identifying and responding to tutors' training needs was the circumstances surrounding consistency of pedagogical components and group cohesion among tutors within a given unit. It was also necessary to take account of training needs felt by unit directors. As well, tutors' training in teaching methods had to be organized to satisfy individual training and upgrading needs felt by practicing tutors, independently of the unit they belonged to. Last, it was necessary to address continuing-education needs revealed by tutors' actual performance in accordance with our institutional responsibility to maintain professors' competency in filling the role of PBL tutors. To do so, it was necessary to use instruments for evaluating the effectiveness of tutors' actions.

As the program of continuing education was subsequently maintained, it went through decentralization, adjustment to individual units and increased availability of individualized, tailored services. Evaluation of the system and quality control for what it yielded came to be priority concerns that opened up a whole new sphere of activity: detailed analysis of the effective tutor's behaviors.

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APPENDIX 1, part 1

SELF-DIAGNOSIS GRID

TASK	COMPETENCIES NEEDED	PRESENT SITUATION (as perceived by me)	DESIRED SITUATION (level I would like to reach)
MANAGE THE PBL METHOD	How well...	- +	- +
	- do I know the basic philosophy and attitudes of the PBL method?	1 2 3 4 5	1 2 3 4 5
	- do I know the 10 PBL stages and how well can I verbalize them spontaneously?	1 2 3 4 5	1 2 3 4 5
	- can I determine the features of each stage?	1 2 3 4 5	1 2 3 4 5
	- can I identify the stage reached by a group as it occurs?	1 2 3 4 5	1 2 3 4 5
	- can I assess the execution of each of the 10 stages?	1 2 3 4 5	1 2 3 4 5
	- can I give the group feedback on its execution of each stage?	1 2 3 4 5	1 2 3 4 5
FACILITATE SMALL-GROUP FUNCTIONING	How well...		
	- do I know St-Arnaud's frame of reference for optimal group functioning?	1 2 3 4 5	1 2 3 4 5
	- can I describe the roles and tasks of a group leader?	1 2 3 4 5	1 2 3 4 5
	- can I, in a group situation, identify the tasks appropriate to the group leader?	1 2 3 4 5	1 2 3 4 5
	- can I carry out group-leadership tasks appropriately as needed?	1 2 3 4 5	1 2 3 4 5
	- can I recognize the functional problem encountered by a group in difficulty and help the group find a feasible solution?	1 2 3 4 5	1 2 3 4 5
GUIDE STUDY OF SPECIFIC CONTENT	How well...		
	- do I know the concept tree underlying the problems studied?	1 2 3 4 5	1 2 3 4 5
	- do I recognize when and how to act to foster the learning process?	1 2 3 4 5	1 2 3 4 5
	- do I know the various kinds of questions that foster the learning process?	1 2 3 4 5	1 2 3 4 5
	- do I make judicious use of open questions?	1 2 3 4 5	1 2 3 4 5

APPENDIX 1, part 2

FOSTER AUTONOMY	How well... - do I know the elements of the autonomous learning approach? - do I know the limits and conditions of an autonomous approach? - do I know how to measure a student's autonomy? - do I know the helping strategies that foster an autonomous approach?	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
FOSTER HUMANISM	How well... - do I know the conditions for a rigorous analytical approach? - do I respect my students' values? - do I attend to developing empathy in my relations with others? - do I know the conditions for active listening?	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
STIMULATE MOTIVATION	How well... - do I know the principal motivational theories? - can I identify relevant motivational factors as the situation arises? - can I describe the most effective strategies for influencing student motivation?	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
ASSESS LEARNING	How well... - do I know the principles of measurement and assessment? - have I mastered the act of assessment while taking into account biases in judgement? - do I understand the specific features of the assessment grids used? - do I know how to observe individual students during tutorials?	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
PARTICIPATE IN ACADEMIC ADMINIS- TRATION	How well... - do I know the unit calendar? - do I grasp the unit's place in the program? - do I understand what the system requires of the tutor role?	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
COMPETENCIES REQUIRING PARTICULAR ATTENTION:			

## Payment of Teaching Staff and Funding for the New Program

Jacques E. Des Marchais and Henry Haddad

*Thinkers know that human capital is the  
only one that really counts now.  
- W. Bennis*

It seems Harvard University had several million dollars to develop the General Pathway for Medical Education (Tosteson, 1990). In 1987, Sherbrooke's Faculty of Medicine made ready to embark in a major program change without being able to rely on new funding sources. Five years later, the task was accomplished. How were the Faculty's resources mobilized to accomplish such an expensive change?

### The Practice Plan of Physicians at University of Sherbrooke

Financing for the new program rested entirely on teaching activity units (TAUs) and departmental accounting. These two key concepts are hard to grasp unless one is familiar with the practice plan of physicians at the University of Sherbrooke, a wholly characteristic feature of the Faculty of Medicine.

#### *The North American context*

In 1910, the Flexner Report recommended eliminating the notion of profit from the system of medical education (MacLeod et al., 1986). The consequent reform was remarkably successful over the quarter-century that followed, but Flexner was nevertheless not in a position to anticipate certain changes that took place.

Prior to World War II, most medical faculties relied on the service of a small regular, full-time teaching corps, most of whom were basic researchers. For clinical teaching these faculties had recourse to physicians who taught part-time on a voluntary basis. Around the 1950s, clinical departments were formed with full-time professors. This expansion coincided with the development of medical subspecialties and rapid progress in clinical research.

During the seventies, new economic constraints affected funding for clinical research in the States. Clinical departments went in search of new sources of funding in order to maintain their research. Full-time members of the teaching staff pooled the income from their clinical practice to pay salaries and maintain university programs. In some faculties, this arrangement included all clinical departments; in others, only some. In most, the dean

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or department heads saw to the plans and implementation, but in some cases this responsibility fell to all members of the faculty.

In 1977, the Association of American Medical Colleges (AAMC) remarked that plans of this kind had now become essential to the effective operation of medical faculties concerned to maintain the quality of their programs despite a drop in funding from other sources (Hilles et al., 1977).

It is now acknowledged in North America that the funds generated by these "practice plans" are essential to the survival of medical faculties. Given the gap that would otherwise obtain between salaries for clinical teachers and teachers of the basic sciences, most faculties admit that they need their clinical revenues to remain competitive with private practice.

In a report published in 1989, the AAMC noted that revenues pulled in by patient care now accounted for a substantial proportion of medical faculty funding (Association of American Medical Colleges, 1989). These revenues also pay for services rendered by medical faculties to the hospitals they are affiliated with. In 1987-88, at least 39% of medical faculty revenues was derived from these plans; in 1960-61, it had only accounted for 6%.

Moreover a properly designed medical faculty practice plan is often essential to the faculty's accomplishment of its missions. It should pursue these objectives (Thrower et al., 1983; Bentley et al., 1991):

- Provide clinicians with competitive salaries, allowing them to offer high-caliber care in university clinics.
- Provide for high-caliber clinical teaching owing to a wide range of practice experience.
- Ensure that administrative work takes the form of simple routine.
- Offer a competitive setting for practice, enabling the medical faculty to recruit and retain high-caliber academic clinicians including researchers.
- Generate more revenue, enabling the medical faculty to maintain not only its clinical teaching but also other teaching programs, research, publications, and so on.

#### *A history of the medical practice plan at Sherbrooke University Hospital*

In his history of the Centre Médical de l'Université de Sherbrooke (the Medical Center at the University of Sherbrooke), the University's former rector, Monsignor Roger Maltais points out that along with the hospital, socialized medicine, and the abolishment of departments, in 1961 full-time faculty was one of the novelties the Faculty of Medicine prided itself on (Maltais, 1980). According to the document from 1964 setting out its objectives, the centre included a university hospital with full-time medical personnel that served for clinical teaching. From this principle group practice flowed naturally and led to the pooling of revenues derived from clinician-teachers' medical activity.

In 1964, the University called for a study "of the regulations governing intake, distribution, and administration of professional fees received by professors in the Faculty of Medicine, a portion of which comes to them as determined by scales set out by the Faculty (Maltais, 1980)". In 1969, the Faculty's 71 founding clinician-teachers formed a civil partnership specifically for the practice of medicine in a university setting. Already, some were speaking of inoculating themselves against the virus of the almighty dollar.

The mission of the Société des médecins de l'Université de Sherbrooke, as stated in 1992, was:

to bring together physician-teachers in the Faculty of Medicine who accept from the outset the Faculty's requirements and methods of operation with the aim of practicing academic medicine to high standards without pecuniary competition, in order to deliver the best possible care and allow members to carry out the teaching and research required by the Faculty (La Société des médecins du Centre hospitalier universitaire de Sherbrooke, 1969).

Right from the start, the Société des médecins and the Faculty's development were intimately linked. The Société was constantly called upon to keep its orientation and operating methods in line with the Faculty's missions, objectives, constraints, and action plans. Similarly, the Faculty could not ignore the objectives and constraints of the Société, whose mission included teaching and research, quality of care, and its members' financial welfare. To ensure each its own viability, both were obliged to maintain constant respect for joint objectives.

The Société des médecins has exclusive ownership of all of its members' fees, honoraria, and professional revenues, whatever source they may derive from. These exclusive rights constitute a distinctive feature of the Société. Members pool their skills in the practice of medicine in a university setting, and each one grants the dean of the Faculty the irrevocable and exclusive right to determine his or her maximum annual revenue from the Société.

A seven-member Executive Committee administers the Société's day-to-day affairs; the dean is an *ex officio* member.

#### *Applying the practice plan under the TRMPA system*

During its first years of existence, monies from the Société des médecins were dispersed largely in the form of end-of-year surpluses. They also served to fund some clinical and basic research and contributed to the payment of salaries for members of the Faculty's management. In 1981 however, a University financial crisis reduced the number of faculty positions from 149 to 126, reducing the Faculty's budget by 15%. The practice plan enabled the Société to take under its wing members who had lost their jobs, thus establishing solidarity among members.

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In order to plan for the future prudently, the dean asked a task force to examine how the teaching staff could be maintained and developed. In 1984, a document was issued that determined how funding derived from University sources would be distributed (Faculty of Medicine, University of Sherbrooke, 1984). This document restated the indissoluble threefold mission of the Faculty of Medicine - Teaching, Research, Management and Professional Activities - from which the TRMPA system was derived. By means of its internal financial organization, the Faculty thus shouldered its mission to produce, transmit, and apply knowledge. The necessary resources are derived from University monies, fellowships to researchers, research grants, and income from clinical services.

University monies are used to fund only teaching and research and any Faculty costs relating to management of those two missions. Through its clinicians the Faculty provides medical services to its hospital, but the resources needed for this clinical work are funded by the Société des médecins, which receives all medical fees earned by its member clinician-teachers. The money needed to run the hospital and pay its paramedical and administrative staff comes from government sources.

The Faculty put into place a management system that could maintain a due balance between the goals pursued and tasks accomplished, on one hand, and the powers that be - departments, Faculty management, and clinicians - on the other. A teacher could thus be involved in various responsibilities agreed upon with his or her department head: teaching, research, management and professional activities, the teacher's "yearly TRMPA". She or he draws a salary for involvement in each of these tasks.

Every department head comes to an agreement with the dean yearly about his or her group's objectives. The department head then works with his or her colleagues to assign tasks and responsibilities; these must be accepted by the members of the department. The proportion of a person's contribution to any given field varies according to their background, competency, and professional choices. This system was gradually instituted from the mid-80s on, and by the mid-90s it had become an integral part of the culture of the Faculty of Medicine.

The Société's practice plan has become a powerful tool for developing a medical practice dedicated to tertiary care, recruiting people with the competencies necessary for quality education, creating new research teams, and developing a community-based family medicine program.

## How the Practice Plan Operates

Since members' clinical fees for service received by the Société is deposited into its bank account, professors no longer need concern themselves with administration in relation to their practice. Just as clinical revenues are the proceeds of clinical fees for service, teaching income is generated by a whole series of tasks related to teaching. These tasks, too, are therefore paid by the clinical service and recorded to the credit of the department concerned under the system of teaching activity units.

### *Teaching activity units*

The system of teaching activity units (TAUs) is very simple. The University assigns the Faculty's budget in line with funds allocated by the Ministry on the basis of disciplinary *per capita* cost: the number of students enrolled in a given faculty's program determines its budget. Using a system of units, the Faculty converts every teaching position into roughly 1,100 TAUs, using an equivalency defined in 1988, which amounts in 1995 to some CAD \$65,000. Each TAU is thus equivalent to a set monetary value, namely the average yearly value of a teaching position, divided by 1,100 TAUs.

These units make it possible to pay for fulfillment of the Faculty's teaching mission at fair value and according to each person's true contribution. As of 1995, research was not converted into TAUs, except to the extent that it was involved in the education of students enrolled in master's and doctoral programs, according to the number of credits assigned.

In a word, teaching is paid for in line with the teaching tasks performed, using units converted back into dollars, whereas clinical work and medical care are paid for in dollars per clinical service.

Take for example 1989-90. In that year 121 teaching positions corresponded to 135,000 units distributed as follows: 36% for undergraduate studies; 25% for all 28 postgraduate educational programs; 11% for master's and doctoral studies; 3% for a series of other programs; 13% for all teaching-related administrative operations taken on by Faculty and departmental management; and 12% in the form of research credits. Thus, in that year 75% of the Faculty budget was assigned exclusively to its teaching mission, not including administrative costs.

Until 1982, the assignment of TAUs and fractions of positions was arrived at through specific agreements between the dean and each department head. In 1982, professors demanded that TAUs be assigned according to the hours devoted to various activities. This led to the assignment of fractions of positions to each department, according to hours devoted to TRMPA activities.

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TAUs were weighted according to the nature of the university activity. To show how the system worked, let us look at the activities of Dr. Lafortune in the Obstetrics-Gynecology Department. Dr. Lafortune gives lectures, conducts a course in semiology, a clinical clerkship rotation, lectures to residents, and in-service work (See Table I).

Dr. Lafortune’s teaching activities will be paid in TAUs. As for postgraduate programs, the Faculty assigns a budget of TAUs allocated to the various departments according to their activities and their number of residents. Thirty percent of the budget is for administration: intake of residents, distribution of rotations in various hospitals, program update and management, and involvement in interdisciplinary teaching activities. The remainder (70%) is allocated to supervisory activities, according to the number of residents’ rotation days in the clinical department. Thus, for the six residents that the Obstetrics-Gynecology Department receives regularly at the university hospital, the Department will have a given number of TAUs credited to its account at year-end.

Table I. Some kinds of activities paid in TAUs

Activity	Units/hour	Example	Result
Lecture	3 units/hour	3 hours on shoulder dystocia	9 units
Semiology course	2 units/hour	2 hours on uterine height	4 units
Rotation	2 units/day/student	4 clerks	8 units/day (for 1 teacher or group)
Undertaking the scientific direction of a CME day	15 units/half-day + 5 units/half-day	Conducting a day-long workshop for general practitioners on at-risk pregnancies	20 units
Moderating an in-service session	1 unit/contact hour	2 hours as moderator, Scientific day-long workshop on urinary problems in pregnant women	2 units

*Assigning TAUs under the new program*

To illustrate how the TAU system is applied under the PBL program, let US suppose that Dr. Lafortune acts as a tutor in the unit on reproduction. This work is paid for with 75 TAUs over a four-week period (Table II).

Dr. Lafortune knows that some of her activities are more profitable than others. The Faculty has asked clinical departments to dedicate 30% of their time to teaching, 50% to clinical activities, 15% to research activities, and 5% to management and professional matters, whereas in basic research, departments must dedicate 70% of their time to research. Moreover, every teacher must act as a PBL tutor for two units a year or, if only assigned one, contribute to the clinical-skills teaching sessions. Dr. Lafortune, who enjoys teaching, also acts as a guide in second-year clinical-skills sessions. All of her teaching activities, taken together and paid for in TAUs, correspond to approximately one-half of a university position. The monetary value of this half-position is credited to the Obstetrics-Gynecology Department account.

Table II. A tutor's payment in TAUs for one four-week problem-based learning unit

ACTIVITY	HOURS	WEIGHTING	RESULT
BEFORE: Meeting	3	1	3 units
DURING: Tutorials (2 x 4 weeks x 3 hrs)	24	1,5	36 units
Weekly meetings (1 x 4 weeks)	4	1	4 units
Preparation (8 tutorials x 1.5 hr)	12	1	12 units
Formative assessment (8 students x 1 hr)	8	1	8 units
AFTER: Meeting	1	1	1 unit
Summative correcting bee	6	1	6 units
Upgrading	5	1	5 units
TOTAL	63		75 units

Departmental accounting

Departmental accounting takes account of all of a department's costs (debits) and revenues (credits) deriving from teaching, research, management, and clinical activities. Table III presents the relevant data for clinician-teachers in the Obstetrics-Gynecology Department. Every department, no matter how small (even if it numbers only two clinicians), is treated as a distinct entity for financial purposes. The aim of the system is to measure a department's productivity and make an equitable distribution of surpluses produced by all its professional activities. There must therefore be other income to make up for the monies

committed to paying professors: this income derives from clinical practice. Let US take a more detailed look at these various components.

#### *Individual and direct costs*

Every clinician-teacher represents a precise cost to her or his department, since besides direct and indirect costs, the individual costs associated with a professor include a yearly predetermined, assured total income. This income comprises not just the professor's academic salary, which is fixed according to his or her rank on a scale, but also an amount for anticipated fees from the Société des médecins. The academic salary engenders costs in the form of fringe benefits (13% in 1989: retirement fund, insurance, and so on). For example, in the case of Dr. Lafortune all of these individual costs amount to 83% (for the purposes of the illustration, Dr. Lafortune represents the average of Obstetrics-Gynecology professors).

Next we go to direct costs. This professor enjoys departmental benefits (entertainment expenses, travel expenses, professional fees). In Dr. Lafortune's case, these benefits amount to additional costs of 8%.

#### *Indirect costs*

The Faculty's administrative costs, including the dean's pay, are borne by all professors. These indirect costs are distributed on a *per capita* basis among all departments. Members of the dean's Office dedicate much of their time to managing the Faculty's affairs, while the dean's time is wholly given over to this. These members of management are grouped into a fictional department in order to apply the departmental accounting system. They have less time to give to clinical and teaching activities; their excess costs are distributed among all professors, being converted into an indirect cost in the accounting of other departments.

The same thing applies to all the costs related to managing the Société des médecins' practice plan. These costs include the administrative costs for medical services delivered, billing for professional fees, and other administrative work. In 1995, all these costs were distributed among the 200 clinicians exclusively on a *per capita* basis.

To this must be added a certain sum that supports the work of the Centre de Recherches Médicales de l'Université de Sherbrooke (CRMUS) (University of Sherbrooke's medical research center), contributes to a special early retirement fund, provides for maternity leaves, and so on. Every year since 1969, members of the Société have donated to the CRMUS to promote Faculty research. In 1994-95, these donations have equaled 2% of professional fees billed. The total amount of donations is distributed equally among all clinician-teachers. Through this savings arrangement, the Société's members created a nest-egg should the Faculty encounter hard times.

The indirect costs attributed to Dr. Lafortune, then, amount to 9% of her total annual costs. The Faculty fund also grants departments subsidy credits to compensate for research activities and administrative work that benefit all: chairing the Société des médecins, the professors' association, the Faculty Assembly, and the university hospital's Council of Physicians, Dentists, and Pharmacists.

The sum total of these direct and indirect costs thus represents the real cost when a new member becomes a part of the Faculty-Société des médecins system, as when Dr. Lafortune was hired. These costs must be offset by revenues, shown here as departmental credits (Table III).

Table III. An example of departmental accounts: statement of costs, credits, and financial objectives

INDIVIDUAL COSTS University salary* Academic fringe benefits (13%) Fees to the Société des médecins Retirement fund, disability insurance, etc	83%
DIRECT COSTS Entertainment expenses Travel expenses Professional fees, liability insurance, etc	8%
INDIRECT COSTS Faculty administration Management costs for Société des médecins Centre de recherches médicales de l'Université de Sherbrooke (CRMUS) (University de Sherbrooke's medical research center) Early retirement fund of the Société des médecins	9%
TOTAL PROFESSORS' COSTS	100%
CREDITS Teaching: four positions Administration Research	31.5% 1.5% 5%
TOTAL CREDITS	38%
FINANCIAL OBJECTIVES (costs - credits) Necessary income from clinical billing	62%

*Credits for teaching activities, revenues, and surpluses*

Credits for teaching activities are assigned to each department in the form of fractions of a teaching position, equivalent in dollars to teaching activities carried out over the year and accounted for as TAUs. Although permanent teaching positions are assigned to those who enjoy academic job security, all such individuals must earn their TAUs to ensure their department gets its proportion of teaching positions. In the Obstetrics-Gynecology Department, these credits account for 31.5% of the total. One department member won a research grant, pulling in 5% of credits. Last, 1.5% is assigned for the department head's administrative responsibilities. In total, department members earned 38% of TAU credits to offset costs.

Under this system of position allocation, the Faculty can apportion fairly among the departments the teaching-related funds placed at its disposal by the University. The apportionment reflects the extent to which a department's members have actually contributed to teaching, research, and management in the educational programs for which the Faculty is responsible. Although the system is complex, it has proven to be effective and balanced.

*Financial objectives*

The sum total of individual, direct, and indirect costs, less the value of credits for teaching and research, yields the negative balance to be made up. This constitutes each department's *annual financial objective*, to be attained from clinical revenues (Table IV), to offset costs. In the example provided here, this objective represents 62% of the Obstetrics-Gynecology Department's costs. This applies as well to Dr. Lafortune, who represents the departmental average.

It is easy to see why this system requires *exclusive rights*, which were already in place in the Faculty. In signing his or her contract with the Société des médecins, every clinician-teacher makes a commitment to turn all of his or her professional revenues without exception over to the Société, whatever may be their source: patient care, lectures, consultations, sponsorships, and so on.

The financial objectives component renders departmental accounting a valuable tool for promoting clinical productivity (pulling in clinical revenues) under a practice plan system in which all parties are interdependent. Any member of the Société can apply to its director to follow its financial progress monthly.

*Deficitor surplus*

The difference between the financial objectives and actual clinical billing (or the total of clinical billing and TAUs) thus constitutes a department's year-end surplus or deficit. In order to yield a real surplus, more teaching and patient care must be conducted. Since patient care is much more profitable, teaching inevitably figures as a *losing* factor in this equation.

### *Distributing the surplus*

When a department has a surplus, it requires a *right to benefit* from the surplus yielded by the Société des médecins after collective costs have been borne. The Société's annual surplus is distributed to members in the form of periodic bonuses and merit bonuses, following recommendations to the dean from a committee of clinical peers. These recommendations are submitted to the Société des médecins' Executive Committee, the assembly of department heads (ADH) and the dean's Office for input. Armed with all this counsel, the dean makes the final decision, which traditionally reflects a "degree" of consensus.

The dean is the only person answerable to the University for the Faculty's budget, while the Société des médecins answers to its members for the fair distribution of fee revenues. To ensure equity, both these funds, the one derived from the University and the one that comes from the Société (which is administered by an executive committee consisting of members), are pooled to accomplish Faculty missions.

Once the indirect costs of the Faculty fund, amounting to 32% to 46%, have been absorbed, what is left over is made available to the department and clinician-teachers themselves, in the form of two sets of incentives.

### *Departmental incentives*

A minimum of 10% of the surplus or \$1,500 per member, whichever is the larger amount, is set aside as a departmental incentive for various uses: professional development, computer purchase, extra staff, and so on.

### *Individual incentives*

The remainder is distributed as a supplement to basic total remuneration. This incentive is given to each member of the department on the department head's recommendation and after approval by the dean, and does not exceed a ceiling for total remuneration established yearly following consultation with the committee of peers. The dean allows for the possibility of granting incentives at a level *competitive* with average income from the practice of a specialty in very special cases, and providing the Faculty's missions are respected. As well, the dean *distributes* special merit bonuses each year to a small number of professors who have made exceptional contributions for the greater good.

Where there is the possibility for a surplus, there is also the possibility for a deficit. For various reasons it happens, though rarely, that a department has a deficit. There is no help for it: the system as a whole must come to their aid, which "swells" the needs to be filled by the Faculty fund. Each of these cases is very carefully examined. The department head is called to see the dean and an action plan is adopted. Corrective measures are closely monitored. If many departments decided to "live on" the system, the latter would not last long. Its strength resides in its stability and the collective will to make it last.

Fig. 1 presents an overview of the processes that form the Faculty’s three management tools, namely the system of assigning positions; reconciliation of departmental accounts; and the system for distributing surpluses derived from three funding sources: the University’s staffing budget, converted into TAUs, research grants, and all other revenues, in particular clinical revenues. These three systems make it possible:

- for the Faculty to fulfill its mission of teaching, research, and clinical services;
- for clinicians to profit from their clinical productivity;
- for teachers to carry out their teaching and research responsibilities;
- and for members of the Société des médecins to contribute to the Faculty’s growth while deriving equitable benefits from the general productivity.

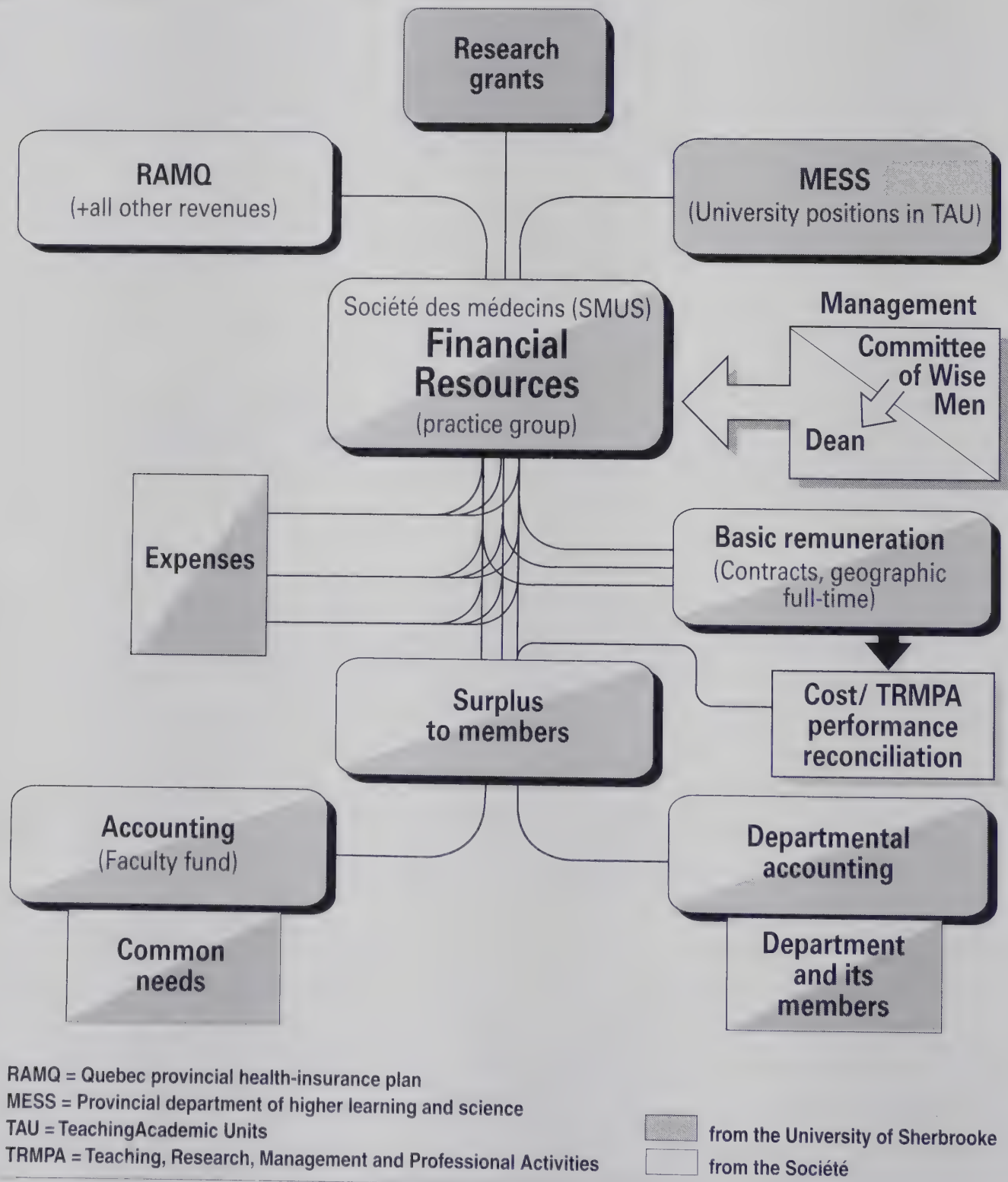


Figure 1. Funding Medical Faculty - clinician-teachers

The Société's accounting in the matter of revenues, levies, expenses, and financial benefits reflects all the activities it conducts in its members' name. Any temptation to carry clinical practice to excess is counterbalanced by the system of group contributions and the ceiling on remuneration.

As a component in a professor's remuneration, the teaching salary need not be translated into an equivalent amount of teaching time. The allocation of positions enables the Faculty to reinvest credits corresponding to the teaching conducted by every member of a department. Thus what the Faculty can offer clinicians is competitive with the private sphere; if it were not, the Faculty would find it difficult to recruit the teachers it needs for both undergraduate and postgraduate education.

Can the system put in place by the Faculty and the Société des médecins hold up under the new PBL program? After all, it is more expensive to teach groups of eight students than a whole class. It will be recalled that at the time of the new program's approval, the University was not prepared to grant supplementary funds to implement the reform. How could the reform be managed without the hope of fresh contributions from the University?

## The Cost of the PBL Program

What could be done to raise the financial resources needed to carry out such an expensive change? The sociopolitical climate that stressed financial controls and stability could easily make the implementation of the new program seem even more threatening.

In 1987, the dean assured the Rector that these changes would be carried out with existing resources, providing the University sustained its contributions to Faculty financing. Departments were also assured that the change would not be made at the expense of postgraduate programs, advanced study, and research. Department heads accepted the reform on condition that it would not cause serious accounting problems.

In November that year, an *ad hoc* committee of the ADH examined the criteria for conversion to TAUs. They recommended maintaining a *quantitative* approach to assessing teaching responsibilities, in order, among other things, to improve the process of recruitment and promotion. They advised, however, the avoidance of *microscopic subdivision of criteria*, and consideration that criteria be integrated *into a new holistic conception of teaching responsibilities*. They considered it important to budget a total number of TAUs for each major sector beforehand. Last, the committee stressed that in the weighting of criteria, actual teaching must be kept distinct from work to implement new teaching approaches. They recognized that the allocation of TAUs must distinguish between the actual delivery of teaching and related management activities, on one hand, and tasks specific to the development and implementation of the PBL program on the other. These

recommendations had a critical influence on the assignment of the credits allocated to the process of carrying out the reform *per se*.

Changing the program was understood to require a temporary assignment of extra funds because it was necessary to work on the development of the new program as well as teach smaller, hence more time-intensive, groups.

#### *Teaching the old curriculum and the new*

A comparison of tutorials with lecture-style teaching makes it clear that, under the new system, the contact with students required of professors during first and second years is three times what was called for under the old curriculum. It stands to reason that dividing up a class of 100 students into 12 small groups requires more human resources, even if the duration of the encounters scheduled is reduced. The traditional curriculum amounted to 1,645 class hours in first and second years; PBL tutorials requires 4,880. One hour of lecturing counted for three TAUs, since it entailed two hours of preparation. Under the new system, 1.5 TAUs are assigned for each tutorial hour (Table II). Here we have one observation.

And now for a second observation: in comparing academic year 1990-91 to 1986-87, we find that the cost of the first two years of the PBL curriculum is higher by 111% (18,449 TAUs versus 8,979 under the old curriculum). The costs include those of developing the curriculum. Yet third year in the new curriculum lasts only one trimester and costs no more than 3,085 TAUs (Table IV).

The comparison of the cost of lecture courses and laboratories for the first three years of the old curriculum (1986-87), i.e. 6,597 TAUs, with the cost of tutorials and other activities, including laboratories, for the first two and a half years of the new (1990-91), i.e. 15,125 TAUs, shows an increase of 8,528, not even including the teaching of clinical skills and rotations. And therein lies a third observation: the introduction of PBL, *without taking its development into account*, costs 129% more for a class of about 100 students.

Clinical skills are spread out over the whole period of preclinical training and replace teaching clinics with patients as well as the rotations of the second and third years of the old curriculum. The cost of those rotations in 1986-87, 12,003 TAUs, must be compared with a cost of 4,342 TAUs for clinical skills in first, second, and third years in 1990-91, for a net reduction of 7,661, or 64%. That is, the new longitudinal unit on clinical skills costs only 36% of comparable teaching under the old curriculum. A fourth observation.

Under the old curriculum, rotations in third and fourth year cost 8,195 and 29,441 TAUs respectively, for a total of 37,636. Adding 3,308 TAUs for the second-year rotations, we arrive at an overall cost of 41,444 TAUs for clinical education under the old curriculum. The new curriculum reduces the cost of rotations significantly. Adding the cost of clinical skills in the first three years of the PBL curriculum, that is, 1,194, 1,898, and 1,250 TAUs in first, second, and third years respectively, to the 19,324 TAUs of the clerkship rotations,

Table IV. Unit costs of the traditional curriculum (1986-1987) and the PBL curriculum (1990-1991)

Traditional curriculum 1986 - 1987			PBL curriculum 1990 - 1991		
Courses Laboratories	1st year		Tutorials Development Other Skills	1st year	
	2465			6772	
	188			1046	
				203	
				1194	
	2653	2,653*		9215	9,215*
Courses Laboratories Rotations	2nd year		Tutorials Development Other Skills	2nd year	
	2372			6480	
	146			1052	
	3808			304	
				1898	
	6326	8,979*		9734	18,949*
Courses Laboratories Rotations	3rd year (8 months)		Tutorials Development Other Skills	3rd year (4 months)	
	1384			1161	
	42			469	
	8195			205	
				1250	
	9621	18,600*		3085	22,034*
Rotations Management	Clerkship (15 months)		Rotations Management	Clerkship (18 months)	
	29,441			19,324	
	2736	48,041*		4727	41,358*
Total		50,777	Total		46,085

Laboratories = laboratory activities;tutorials = PBL tutorials; development = improvement work; other = various activities, demonstrations, laboratories, visits; skills = clinical skills.

\* Cumulative subtotal

we find that no more than 23,666 TAUs are expended on clinical education. This amounts to only 57% of the former cost of clinical education. This constitutes a fifth observation.

Table VI shows how we succeeded in financing the implementation of the PBL curriculum without the injection of new funds. It will be observed that a block of over 10,000 TAUs, or 20% of the cost of the old curriculum, has been shifted from clinical rotations during the clerkship to first-year tutorials. At the same time, the cost of former second- and third-year rotations has been reduced through the efficiency of the unit on clinical skills, and the TAUs thus freed up assigned to PBL-unit development work. Our sixth observation is that TAUs within the block already assigned to the MD program have been shifted.

Finally, when the total cost for 1990-91 (i.e. 46,085 TAUs) is compared with that for 1986-87 (i.e. 50,777) a net reduction of 9.2% after three years of operation can be observed. This constitutes the seventh observation (Table V).

Table V. Seven observations on the cost of the PBL curriculum

1. Introducing PBL replaced 1,645 lecture hours with 4,880 tutorial hours.
2. Cost of the first two years of PBL, including development costs, was 111% higher than the cost of the traditional curriculum.
3. Without factoring in development, the conduct of tutorials for the first three years cost 129% more than the old methods.
4. Implementation of the longitudinal unit on clinical skills resulted in a reduction of clinical-education costs by 64%.
5. Total costs for clinical education including the clerkship have gone down by 43% under the new program.
6. A budget amounting to 20% of the costs of the old clerkship has been shifted to PBL tutorials and their development.
7. Overall in 1990-91, the new curriculum cost 9.2% less than the old one.

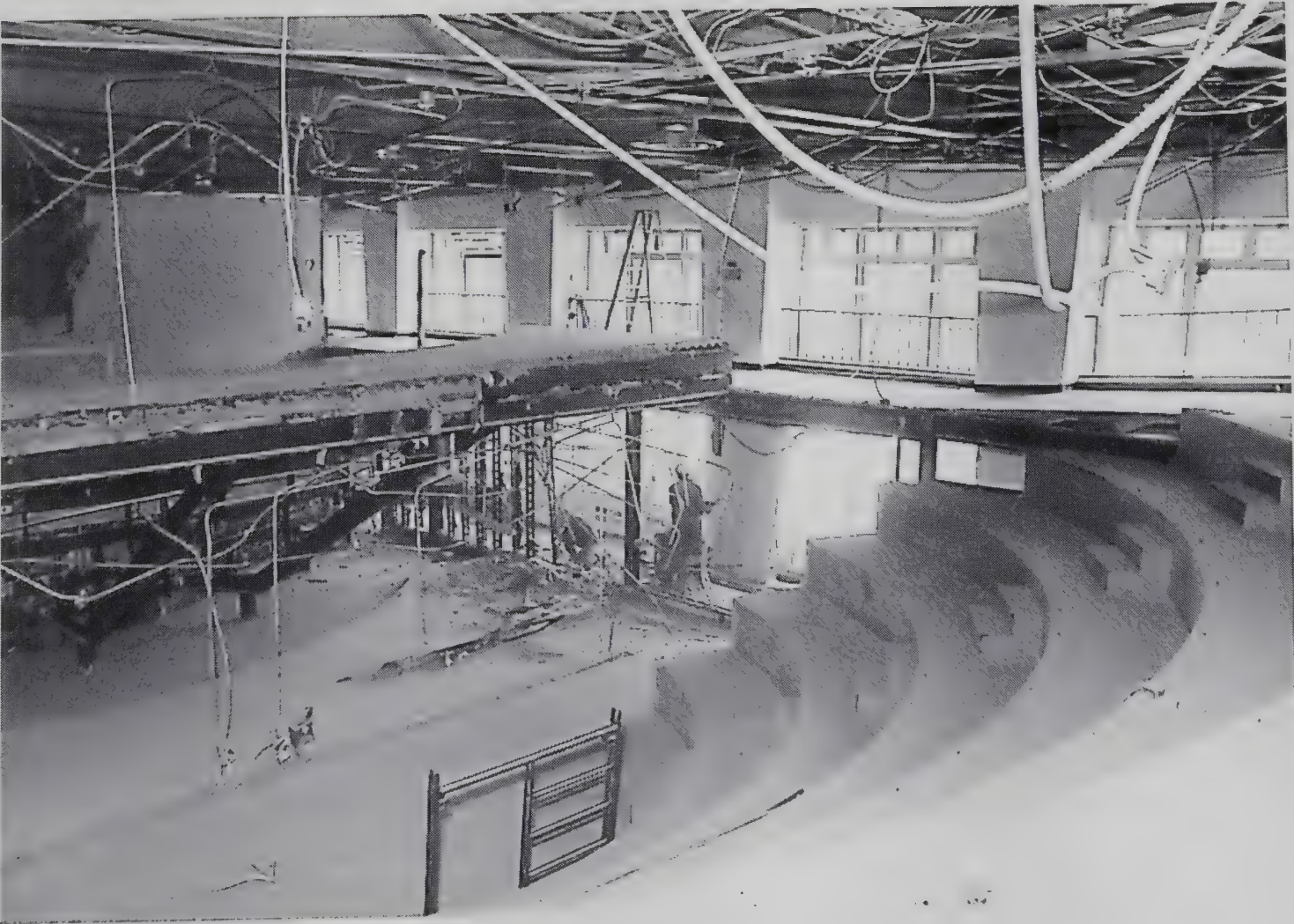
Several factors relating to the situation that prevailed at the time when the new curriculum was implemented account for the fact that the transition occurred relatively painlessly. First, under the old curriculum clerkship rotations were disproportionately "rewarded" in comparison with other teaching responsibilities. From the point of view of departmental accounting, it was far more profitable to take in clerks than to give lecture courses. Second, in postgraduate education programs, payment is part of a social contract between clinicians and the administration, which leads to the injection of sizeable blocks of TAUs into departmental accounting. Thus in 1989 25% of the teaching budget was assigned to this sector. This level of funding to postgraduate programs constitutes a larger proportion at Sherbrooke than elsewhere.

The proportion of postgraduate education programs that is self-financed varies from country to country. For instance, in France no teaching budget is assigned. In American programs linked to universities, budgets for this are also insignificant. In Canada, all residency programs are linked to universities. In English Canada, the monies assigned to these programs rarely exceed 15% of a faculty's overall budget. In the other two French-

language medical faculties of Quebec, percentage assigned to this is less significant than our own. At Sherbrooke, financing for postgraduate education has led to clinical departments' viewing their teaching of both clerks and residents as a single whole. This is evident in the fact that transfers from one budget to another made when the reform was implemented did not, to all intents and purposes, affect departmental accounting, a clear sign that the same clinicians continued to carry out the modified responsibilities without losing their share of teaching positions.

Table VI. Expenditures in developing PBL units expressed as teaching activity unit costs for 1987-1992

	86-97	87-88	88-89	89-90	90-91	91-92	Average cost/ year
1st year	----	1724	1380	600	926	627	1051
2nd year	----	----	1492	824	932	807	1014
3rd year	----	----	-----	338	289	191	273
Total		1724	2872	1762	2147	1625	



Taking advantage of a special subvention, in the fourth year, three small amphitheatres are transformed into 16 small rooms for tutorial sessions and clinical skill acquisition sessions.

The operation as a whole made it possible to find the TAUs necessary to *assign appropriate status* to PBL tutors' responsibilities, making their recruitment relatively easy. This redistribution of resources demonstrates the flexibility and effectiveness of the way Faculty budgets are converted into TAUs. It allowed for the development, implementation, and maintenance of PBL tutorials as well as the complete restructuring of activities related to clinical skills learning. Additionally, the number of positions assigned to each department remained stable so long as members of a department participated in PBL tutorial activities, and this constituted a further incentive.

#### *The development budget*

In 1990-91, the new curriculum costs less overall than the old one. A study conducted in 1992 compared the anticipated costs at the outset, in 1988, with the average cost over five years of implementation (1987-92) for each major activity; this was also done for each of the four years of the curriculum. True savings of 13% were observed. Savings were roughly equal over the first three years, 28%, 35%, and 34%, but the clerkship cost 14% more.

A few words of explanation about the costs of developing such a curriculum. In 1988, a special budget of TAUs was set aside, 60% of which were intended for use in the first year, 20% in the second, and 10% thereafter. A look at Table VI shows that that is not how things happened.

In actual fact, expenditure of TAUs was slightly higher in the second year of implementation, in 1988-89, as well as every time a new year of the curriculum was launched. What is remarkable is that development costs yearly remained 35% to 55% lower than was anticipated. Initial budgeting for development costs by vague (60% for the first year) was the product of a relatively mechanical conception of teaching. The reality was otherwise, as may be seen in the development expenditures of the curriculum's first five years. Even though the director of the program had discretionary power over the assignment of these TAUs, this profile of expenditures corresponds strictly to reality. Things were not perfect the first year. It was necessary to continue investing in order to adjust, improve, and renew. Changing heads of PBL units was probably the factor that most influenced use of these development TAUs. Naming a new director often corresponded to a need for major revision to PBL problems, indeed production of a whole new edition. The second significant factor flowed from the data gathered through internal curriculum evaluation mechanisms (Chapter 12). These data allowed the program director to put pressure on the unit director to force improvement in problems and examination questions, the two most significant contributors to development costs.

#### *System costs*

When a major pedagogical reform is undertaken, the administrative infrastructure must also adjust. In 1990, a study on the productivity indices for secretarial support revealed that the old curriculum called on secretaries to take a whole series of actions including receiving

course notes, paginating them, photocopying them, and distributing them. The new curriculum required 19 such steps, including preparing the Student and Tutor guides and, above all, activities related to assessment. In short, implementing the new curriculum was to require a set of operations that would take up 3.7 times the time required for managing the old curriculum, at least during the first years of implementation. This analysis led to addition of one secretarial position. In fact, after four years secretarial activities stabilized with this addition of one position and the formation of a second team to help with tutorial classrooms, clinical skills, and instructional material. The system is now functioning harmoniously, but secretarial responsibilities have changed completely (Table VII).

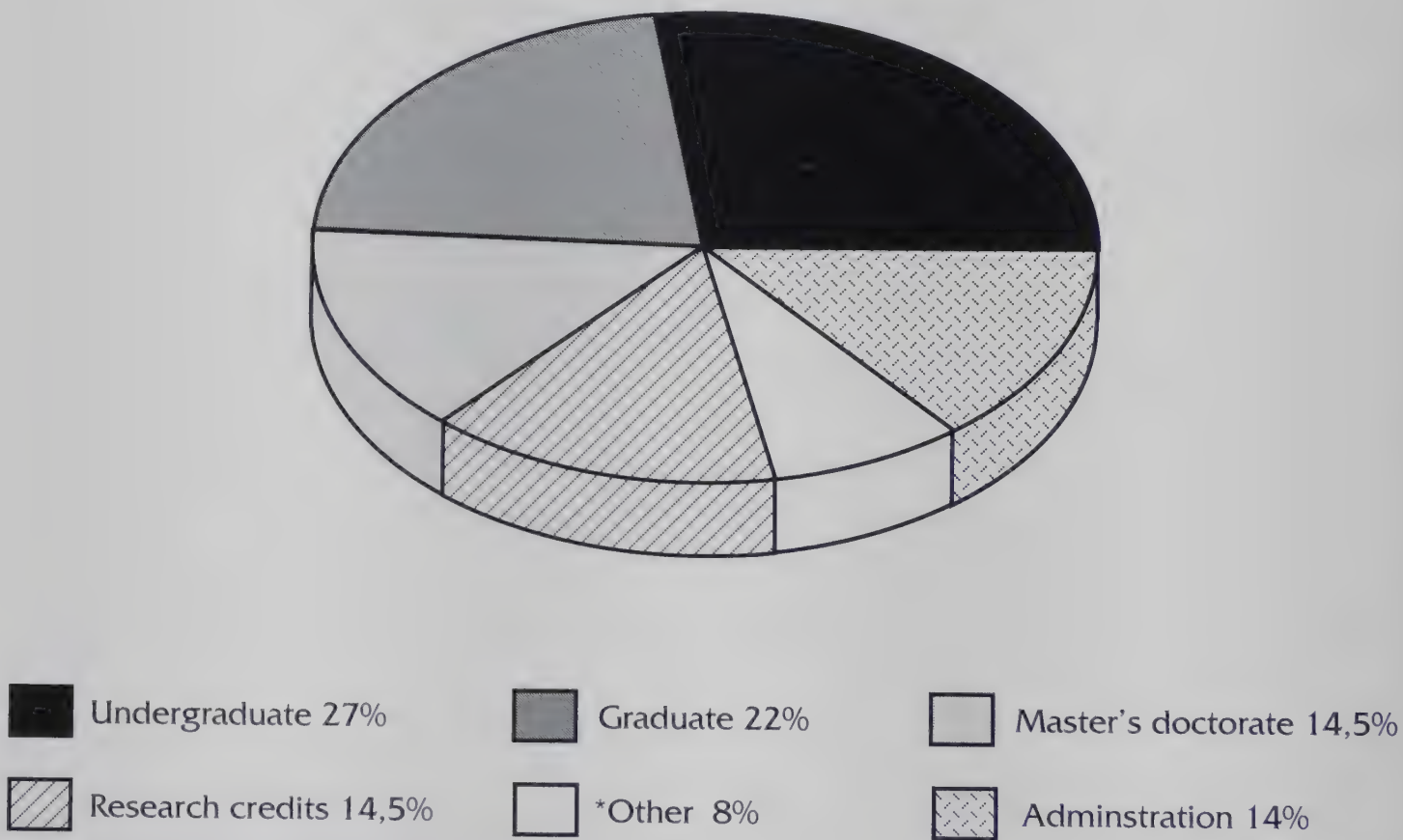
Table VII. Five observations about system costs

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1. The system for controlling use of teaching activity units improved and allowed for significant system savings.
  2. Overall costs were lower by 13% than the budget forecasts made three years in advance. The savings were as high as 30% for the first years of the curriculum.
  3. While development costs during the first year were lower than forecast, they rose to 40 to 80% of their initial forecasts during subsequent years.
  4. A yearly budget to improve and replenish the bank of PBL problems and examination questions proved necessary.
  5. Secretarial responsibilities changed completely. A second secretarial team was needed to provide classroom logistical support and instructional materials.
- 

Three years following the start of implementation, distribution of TAU budgets over the Faculty's major programs had varied somewhat. Twenty-three positions had been added, going to other programs of study than the MD (for example, the bachelor's in nursing sciences) and - in large part - to the basic research and clinical programs. Dean Michel A. Bureau has in fact been working since 1988 to improve our research performance. Once these additions were made, teaching credits, which had totaled 75% of the Faculty budget in 1989, represented no more than 71.6% in 1992 (Table VIII and Fig. 2). The changes favored advanced study (+3.4%), other programs of study (+4.9%, largely the bachelor's in nursing sciences), and funding to research (+2.5%), at the expense of the postgraduate program (-2.7%) and (most of all) the MD program (-9.0%).

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These developments were in line a Faculty trend. We were a *teaching university* that assigned no more than 10% of the budget (12% in 1989) to research expenditures, whereas a minimum of 25%, preferably 33%, is to be expected according to dean Bureau's comments to the Assembly of Faculty Members in January 1993. These proportions are based on the premise that a *research university* assigns 60% of its budget to research and 40% to teaching. All of this revived the debate around an issue that has preoccupied universities for years: should a university be primarily a place for teaching or should it also view itself as a center for research?



\* Other training programs: nursing, biochemistry, continuing education, and community health sciences

Figure 2. Breakdown of University budgets by program in 1992

Conclusion

"We don't have the means to carry out such a curriculum change", was the pat retort of those who opposed the reform initiative in 1986-87. This chapter has shown how we succeeded in mobilizing existing resources taken directly from the budgets assigned to the old MD curriculum, since the University had decided to add no funding.

Table VIII. Distribution of units by program in 1989 and 1992, expressed as a percentage

PROGRAMS	% in 1989	% in 1992
Undergraduate curriculum	36	27
Postgraduate education	25	22.2
Master's and doctoral programs	11	14.4
Other programs: - nursing sciences - biochemistry - in-service teaching - community health sciences	3	8
Subtotal: teaching alone	75	71.6
Administration and department management for teaching	13	13.9
Research: partial credits	12	14.5
Total	100	100

Changing lecture-style teaching to PBL tutorials entailed increased costs on the order of 129%. Yet in 1990-91 the total cost of the program was lower by 9.2% than what it was in 1986-87. The fact is that implementation costs for the PBL program were absorbed through a reduction of the clerkship cost by 20%, a reduction in the cost of clinical skills, greater rigor in management control of TAU expenditures (a system saving), and the cost-free development of the new clerkship. Last, development costs remained relatively stable in defiance of what was forecast.

It was owing to the ingenious system of TAUs that these changes were possible. Under this system, 121 academic posts were transformed into a block of 133,000 TAUs. These TAUs were redistributed according to actual teaching performed in the MD program, and according to the number of clerks and residents in clinical education (during their clerkship or engaged in postgraduate study) and in master's and doctoral level research.

TAUs were reconverted into fractions of teaching positions for the purposes of the system of departmental accounting, by which all revenues (from clinical, teaching, and research activities) of each department are managed with a view to offsetting expenditures (salaries, fringe benefits, travel expenses, contributions to the indirect costs of the Faculty system).

The balance among the various subsystems within the Faculty clinical system is made possible by the unshakeable allegiance of all clinicians to the practice plan. The practice plan requires respect for the principle of exclusive rights and the pooling of revenues from all sources. Yet a clinician-teacher can contribute to overall productivity in the Faculty clinical system by gaining end-of-year incentives for his or her department and financial incentives, sometimes indeed special merit bonuses, for himself or herself. Participation in developing and implementing the new curriculum could therefore have an impact on the yearly occasional bonuses.

It is thus that the loop has been closed within an internally consistent system whose key component, the practice plan, was started when the Faculty was founded. Then came departmental accounting, which was initiated in the early eighties. The method for detailed calculation of TAUs was put in place just at the time the new curriculum was being implemented and decidedly furthered its success. Everything hung together administratively.

While some find that the TAU system is too highly focussed on accounting, the great majority are satisfied with it. The principle of exclusive rights remains sacred in Sherbrooke's Faculty of Medicine: it constitutes a kind of orthodoxy that has survived for twenty years. Payment for PBL activities by the act is highly equitable, even though the system is markedly less beneficial to clinicians, whose specialties pull in very high average revenues. Finally, over these years, master's and doctoral studies and research took on a larger share of the Faculty budget at the expense of teaching programs, especially at the MD level.

This analysis naturally leads to the debate on fundamental issues that continues to challenge our Faculty systems and give rise to tensions therein: should resources be assigned to teaching or research? Although these two missions complement each other, decisions made about them from time to time are revealing of the choice of values of a given setting, stimulating or slowing down personal investment in one sector or the other by teachers, who constitute the only enduring wealth of medical faculties.

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## PART FOUR: EVALUATING THE REFORM

### The Program Evaluation System

Jacques E. Des Marchais

*Evaluation of the program is important in the process to identify strengths and weaknesses. The process is frustrating, however, because what is important is difficult to measure and what is measurable is usually not important.*  
- John Evans

Evaluating the product was the last step in the model for change that we used as framework of reference (Levine, 1985). This step will continue to develop over the years, since it has become the new priority following the clinical-training reform (Chamberland et al., 1992). Our Faculty was not really able to take advantage of the parallel existence of the traditional curriculum and the new program over a period of three years. Few comparisons between the performances of the two cohorts of students were carried out. We, like other institutions, failed to seize the opportunity. Nevertheless, we were able to use a wide variety of measurement and evaluation activities throughout the six-year implementation period.

### Ongoing Facilitator Activities

As the units of the new program were implemented, the evaluation activities followed. Evaluation measurements can be divided into two groups: those relating to the process and those relating to program outcome. While this breakdown is largely accepted in medical-education literature (Holzemer, 1976; Kassabaum, 1990), it is not as useful as one might think. Feedback on the process and program content affect one another. Accordingly, student comments at the end of a unit often lead to a problem being reworked. Written examinations indicate the degree of learning; this kind of evaluation can lead to short-term modification of problems. In this case, process and product influenced problem quality. And while the Medical Council of Canada Qualifying Examination at the end of the clerkship does not figure into our evaluation program, the results influence our perception.

When implementing the reform, the Faculty was less concerned with the final product than with the new-program process. That is why a whole series of strategies were put into place

to facilitate the gradual changes to reform components (See Table I), each of which went into developing the profile for the implementation years.

Table I. Ongoing facilitating activities for the process of the new PBL program

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During PBL units

- Meeting with stewards
- Critiquing the problems
- Individual student unit assessment

After PBL units

- Assessment report from the teacher in charge
- Annual meeting of the person responsible for the unit and program authorities
- Assessment report from the student representative
- Meetings with unit heads
- Tutor workshops
- Summative evaluation of student learning

At year-end and periodically

- Coordination Committee meetings
  - Annual assessment meeting
  - Presentations to the Program Committee
  - Visitor workshops
  - External evaluation visits
- 

How we went about using the different data-collection instruments and mechanisms is described below.

*During PBL units*

*Weekly tutor meetings* - Each week, the PBL unit heads meet with the tutors for about an hour to discuss problem quality and to fine-tune the problem for the upcoming tutorial. The meeting provides an opportunity to start up preparation for formative and summative evaluations, provide instructions to tutors, and to refer to problems encountered during tutorials. Depending on the unit, 60% to 80% of the tutors attend these meetings.

*Meeting with stewards* - At the unit midpoint, the phase coordinator or the program director meets with delegates from each of the small groups of students. These stewards, designated by their peers, serve as liaison between the administration and the students. In the first years of the program, the program director chaired these meetings; it gave him an opportunity to keep his finger on the pulse of the implementation of each unit. Since then, the Preclinical

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Training Coordinator has shared in facilitating these meetings, which are faithfully held weekly for each of the units in the first two years of the program.

Students take advantage of them to express their overall assessment of the unit, problem quality, and tutor performance. Occasionally, they ask for better formative evaluations or express concern about the quarterly summative evaluations. The Coordinator passes on the messages to the Faculty and faculty members, keeps the method from getting off-course, and inquiries about unit climate.

Meetings with the stewards reveal how students are managing their self-directed learning. They also provide an opportunity to clarify the relationship between problems, objectives, and the expected level of study, and between reference works, the problems, and specific objectives. This aspect motivates students to take part in the meetings. As a result, program assessment becomes a secondary and often indirect benefit.

*Critiquing the problems* - In step 9 at the end of each tutorial, the steward has the job of getting student opinion (and sometimes that of the tutor) on the problem's ability to stimulate discussion, the problem's relevance to study objectives, the usefulness of references, and so on.

These assessments and comments provided during the meeting with the stewards enable the student responsible for the unit to draft his or her assessment. This report confirms or invalidates steward allegations, which are only partial in any event. This analysis provides immediate documentation on problem quality and is a valuable tool for the unit head.

*Student individual unit assessment* - At the end of each PBL unit, students have the opportunity to provide anonymous feedback on unit components; this is Sherbrooke's version of the Maastricht instrument (Gijssels et al., 1990) (See Appendix I). The purpose of this evaluation is to have feedback from all students on problem quality, the role of the tutor, topical interest, and learning methods.

"Tutorial evaluation" is an integral part of the preclinical landscape. As soon as they arrive, students are strongly encouraged to comply with this component of the social contract: we periodically need their input in order to improve the quality of our PBL units, on the short term, and to prepare for the accreditation site visit, on the long-term.

#### *After PBL units*

*Assessment report from the teacher in charge* - Theoretically, each unit head must submit an annual unit assessment and suggestions for improvement to the Program Director. This rule was strictly adhered to during the first two years of program implementation. After that, the compliance rate tailed off sharply to about 60%. After five years, only a third of the unit heads took the trouble to provide a written assessment. Although the report was

considered essential at the outset, it has gradually been losing its relevance as the PBL units have gotten up to speed.

*Annual meeting of the person responsible for the unit and program authorities* - Although the number of written reports has diminished, the program director meets individually with all unit heads immediately after a unit has been given and several months before it is repeated to set specific improvement objectives. As a result, the problems used in most units have been revised at least twice. Some units have been completely revamped. In addition, teachers can receive remuneration for developing new pedagogical activities through the university activities units budget (UAU) (See Chapter 10). The amounts distributed in this way have remained high from year to year. These expenditures reflect the efforts of the PBL unit heads in improving teaching materials.

*Assessment report from the student representative* - A student volunteer is responsible for drafting an assessment of the PBL unit for the unit head and the Program Coordinator. The student collates steward assessments, compiles the assessments for each problem, and gathers the opinions of his or her peers. This report, about 10 pages in length, provides a look at the climate in the unit and its organization. It provides an analysis of each problem, critiques references, recommends improvements, suggests other teaching methods (such as dissection sessions during the musculoskeletal unit), and comments on lectures as well as formative and summative evaluation. The report summarizes the strengths and weaknesses of the unit.

During the first year of implementation, assessments were provided for 50% of the units. The number grew to 86% during the second year, then dropped off to 60% for the following two years. In recent years, the rate has increased to 90%, reflecting student interest in taking part in program improvement. The students know that the teachers take into account their opinions, because the students in subsequent years tell them about the changes. These reports objectify the discussions between unit heads and the program administration; they help identify topics for discussion for assessment sessions. This type of assessment and feedback is now an integral part of the preclinical training system.

A clear message emerged during the first three years: the units could be improved based on student comments. We requested more of these reports, but their purpose was more preventive than curative.

*Meetings with unit heads* - Starting in the third year of implementation, the heads of preclinical units were invited to regular meetings with the Preclinical Training Coordinator. Although this was initially seen as a management and, to a certain degree, a training activity, the meetings also served to facilitate the program.

Two topics were on the agenda: current business, which required immediate action (schedule changes), and other items requiring in-depth discussion (for example, the introductory session for PBL units, tutor evaluation, and problem-analysis questions).

Although these meetings have been held sporadically until recently, they are beneficial for and strengthen the image of unit heads, allowing them to continue to play a determining role in program evolution.

*Tutor workshops* - Each year, the tutors are invited to attend a day-long workshop (See Chapter 9) several days before the start of their units. The topics under review are the role of the tutor, procedures, and unit problems. Some topics are looked at in greater detail, such as tutor evaluation of student performance. Since 1990-91, these workshops have been prepared jointly with the unit heads. The workshops also provide an opportunity to examine the findings of the report by the student representative and the recommendations of the Coordination Committee.

*Summative evaluation of student learning* - Student evaluation is an evaluation of program outcomes (See Chapter 5). It is the keystone of any educational program. Each unit head therefore wants to know what impact the problems have on cognitive learning. Tutors want to review the analyzed results and defend their quality and psychometric data before the Evaluation Committee, which has the responsibility for accepting the results on behalf of the Faculty.

Measuring all aspects of learning is difficult due to lack of appropriate instruments. At Sherbrooke, the cognitive domain predominates. When the program was being implemented, the Faculty was especially concerned about performance on the comprehensive examination of the *Conférence des doyens des facultés de médecine du Québec* and on the Qualifying Examination of the Medical Council of Canada.

#### *At year-end and periodically*

*Coordination Committee meetings* - For the last three years, the program administration has been assisted by a Coordination Committee (See Chapter 2), which meets monthly and makes an enormous contribution in adjusting the program. Every two or three years, the head of each PBL unit draws up a "health assessment" for his or her unit. The same thing applies to the clinical skills learning and medical-ethics units as well as other activities such as the clinical immersion rotation and the course on human sexuality. These evaluation, updating, and scheduling activities take into account information from the annual assessment by the head of the undergraduate training program provided to the Dean's Office and the Faculty Council.

*Annual assessment meeting* - Since 1988, annual assessment meetings have been held to provide another look back on the year's teaching activities; 40 to 50 people, including

teachers, students, and administrators, attend to share their recommendations and suggestions. The students convey messages that they deem important. The teachers call for greater participation, decrying, for example, the overly passive role of the PBL tutor at the beginning of the reform.

In 1989, the assessment focused on the role of the tutor. Two years after the program was implemented, it was evident that tutors had to play a more active role. The evaluation sheet filled out by the tutors was causing problems: the students did not like being evaluated in areas other than knowledge. This form of evaluation was retained, but the sheet was redone. We also wanted to improve the quality of examinations, but found it difficult to formulate good problem-analysis questions (PAQ). A working group was set up.

In 1990, the development of preclinical training was contested, with the main focus being on study questions (step 5) and explaining the problem (step 7). Strategies were discussed to increase student interest.

In 1991, three different themes were dealt with. The fact that Introduction to Medical Biology had always been taught by discipline instigated a proposal to develop an integrated approach. A review of the clinical skills unit revealed major administrative problems and inadequacies in individual observation with feedback. As a result, a working group began developing a second edition. Lastly, since it was felt that students in the multidisciplinary unit (third year) needed a tighter framework, a half day was added to the mentor's task for observing the student with a patient.

The 1992 meeting was devoted to reviewing the evaluation system. It was felt that more feedback was needed in order for evaluation to have a teaching value and that greater emphasis was needed on the knowledge acquisition using the spiral model.

In 1993, the assessment focused on the clerkship, which, depending on the clinical setting, was running quite rough. A complete overhaul was needed.

These day-long sessions, systematically held outside the Faculty, have consistently proved very beneficial for the administrators, teachers, and students. In addition to promoting discussion and enhancing know-how, they uncover difficulties, anachronisms, and unwanted deviations.

*Presentations to the Program Committee* - In our Faculty, a whole series of special committees have fulfilled the range of functions of a program committee: Reform Planning Committee, Framework Committee, and PBL Problem Validation Committee. In fall 1990, a program committee, officially created by the Vice Dean Education, was mandated to determine how best to bring program activities into line with the intent of the reform. He invited unit heads to discuss program evolution based on an analysis grid in order to

highlight program strengths and weaknesses. In February 1993, the Program Committee's report played a major role in the move towards complete program revision.

*Visitor workshops* - A complete and sudden change such as ours arouses a lot of curiosity, which is why we developed a workshop for teachers from outside the University who are interested in learning about PBL. Some of the participants come from programs outside medicine.

Over a five-year period, nearly 300 teachers have taken part in 19 workshops. Thirty percent of participants were from Europe; the remainder from medical schools in Quebec and Ontario (two Canadian provinces) and United States, along with attendees from non-medical faculties. In every workshop, we present the program, providing visitors with an opportunity to observe tutorials and discuss with students, teachers, and administrators. It is an opportunity to talk about the merits of our educational choices, learning activities, and evaluation. These encounters are very stimulating and help us to better focus on the goals of the reform, and even to further its development.

*External evaluation visits* - In Canada, every medical school must submit at regular intervals an external evaluation under the auspices of the joint accreditation committee of the Association of Canadian Medical Schools and the Liaison Committee on Medical Education of United States. In addition to evaluating the quality of the MD program, the visitors provide their assessment of the Faculty, its basic sciences departments, financial resources, relations with teaching hospitals, research programs, the quality of graduate training, and so on. The committee's recommendations have a major impact on the evolution of medical school. The visit undeniably constitutes an external summative evaluation. Obviously, the 1989 visit by the accreditation team focused on the new program.

The concept of external formative evaluation is not very familiar and rarely used in medical education. The mere mention of it in Europe raises eyebrows. For our part, in January 1988, we invited a dozen medical and non-medical educators to visit us. For two days, we subjected our program to their scrutiny. The experience was so productive that we repeated it in fall 1988, this time inviting four internationally renowned medical educators to conduct a three-day formal evaluation of our program. We repeated it again in 1991, when our first cohort graduated from the new program. These visits, financed by the Faculty, provided an opportunity to demonstrate our undeniable commitment to the program's success. In spring 1994, we organized our third external formative evaluation site visit.

## Evaluation Outcomes

Teaching evaluation (Aleamoni et al., 1980) is often seen solely as assessment carried out by students. This is not the case with us, even if we consider students our prime source of information.

### *External formative evaluation visit September 1998*

A year after the start of the reform, the Faculty organized our first external formative evaluation, carried out by four medical educators: Robert Colvin, a pathologist at Harvard University (Massachusetts, U.S.A.); Victor Neufeld, Vice Dean Education of the School of Medicine at McMaster University (Ontario, Canada); Gilles Hurteau, Dean of the Faculty of Medicine at the University of Ottawa (Ontario, Canada); and Jean-Jacques Guilbert, former physician-in-chief of health-care personnel training with the World Health Organization (Geneva, Switzerland). Over a period of three days, they met with faculty and students.

Their overall "very positive" impression was based on our three-prong conceptual approach: *needs of the community, self-directed learning, and developing humanism*. They further stated that, in using problem-based learning and «"on-the-job" training, Sherbrooke "implemented principles that educators talk about but rarely put into practice". The task ahead was characterized as "vast and arduous". The years to come would require "even more tenacity and perseverance".

### *Recommendations*

The evaluators' report contained 24 recommendations under four different headings: the program planning process, program structure, assessment mechanism, and tutor training.

#### *Program planning process*

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1. Be even more vigilant in preventing the creation or widening of a gap of misunderstanding between certain teachers and the planning group (with respect to the role, workload, logistics, and so on) by implementing an appropriate mechanism for providing ongoing information.
  2. Reconsider the real amount of time required by everyone to accomplish their tasks; attempt to get additional staff, as needed, in order to make up for underestimating the time required during the start-up and investment period.
  3. Reassure basic science teachers that their disciplines will not be sacrificed and that they will have access to students so that they will be able to facilitate the development of
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their scientific approach and to remedy any shortcomings throughout the four years in the program, notably through serving on unit committees in the three phases

4. With respect to the quality and scope of the humanistic concept, seek out the opinion of individuals outside the health-care system, specifically: philosophers, scholars, clergy, representatives of community organizations, and so on.

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### ***Program structure***

For the most part, the recommendations propose remedies for the acute "coveritis" afflicting the program at this stage of development. This form of curriculopathy popped up throughout discussions with teachers from all disciplines. It even appeared that even the students were exacerbating this widespread infection.

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5. Since the "concept tree" is a useful planning tool, offer the required assistance to teachers to enhance development of it and to make it available to students, towards the end of each unit, after they have already build their own concept tree, for comparison with that used by the teachers.
  6. Gradually have students adopt a more active role in planning their program. To illustrate, in planning their learning activities for units 13 and 14, at the end of Phase II, on the basis of a sufficiently broad priority health problem.
  7. Allow for earlier introduction of clinical learning activities into the program (similar to the clinical immersion) and make better use of the outlying health-care services in Quebec, which have deservedly good reputations.
  8. Take into account the focus on community needs when selecting and building problems for the units that follow.
  9. Take into consideration the advantages to be gained by shifting from an organ/system concept to a "population priority health-care problem" concept to guide in building the program for greater congruence with community needs.
  10. Reduce the number of "problems" by broadening their scope by category were preferably on the basis of priority health-care problems, and by allowing students more time for analysis.
  11. Avoid scheduling tutorials on Fridays and Mondays. Ensure that, as a general rule, one problem is dealt with over two tutorials.
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- 12.Reduce the number of students per tutorial to six (or a maximum of seven). It appears that tutors feel this is a necessity and it is strongly backed by the students.
  - 13.Develop a plan for incorporating the humanistic concept, including a mechanism for verifying that it has been effectively implemented.
  - 14.Develop a plan for incorporating notions of health-care economy, as well as controlling the quality of care and costs during learning activities, including the mechanism for verifying that students have acquired the corresponding competencies.
  - 15.Develop a plan for ensuring that students acquire the skills for finding appropriate information resources and for managing this information in dealing with the problems to be solved.
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### ***Assessment mechanism***

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- 16.Take into consideration advantages to be gained from a pass/fail system that would include justification provided as short narrative paragraphs in order to place more emphasis on learning activities in tutorials and to decrease the feelings of competitiveness between students.
  - 17.Develop open-book "qualifying" examinations in order to give priority to higher intellectual skills (data interpretation and problem solving).
  - 18.Develop tests to measure the degree of student learning autonomy, in particular, their capacity to find useful sources of information.
  - 19.Make absolutely certain that formative evaluation tests are "identical to Qualifying Examinations (in terms of difficulty and discrimination indexes)".
  - 20.In all students in constructing evaluation tools (with respect to the self-assessment objective) and a gradual development of a bank of instruments.
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### ***Tutor training***

The evaluators were impressed with the effort put into tutor training. They strongly approved of the basic training being reinforced by an annual, ongoing training workshop, which has recorded a participation rate of 80%. In their opinion, this training has contributed significantly to reform implementation.

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21. Continue tutor training using the positive aspects of what has been learned in order to demonstrate how problem-based learning, when properly applied, will enable students to successfully master material that has not been "taught" when necessary.
  22. Strengthen the capacity for research in the educational process field, publish findings, and take them into account for promotions.
  23. Reevaluate the active facilitating role of the tutor in order to enhance quality when students formulate problems (step 3), while remaining more flexible about the sequence of the ten steps in problem-based learning when the nature of the problem warrants it.
  24. Explore the possibility of using students who have gone through the PBL program as tutors.
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#### *Coordination committee responses*

Starting in December 1988, the MD Program Coordination Committee began looking at steps that could be taken to follow up on these recommendations. A number were easily settled, such as "reducing the number of students in the small groups" (No. 12). Others, such as "studying the scope of the humanism concept" (No. 4), required long-term strategies.

This initial external evaluation exercise, which was very salutary for us, strengthened our process, turned it into an ongoing action-research project.

#### *Site visits by the liaison committee and the committee on accreditation in February 1989*

In February 1989, we welcome a team comprising three Canadian evaluators, the dean of an American medical school, and an observer from the *Collège des médecins du Québec*. The outcome: after analyzing our documents, four days of interviews, and deliberations, the committee granted full accreditation for a period of seven years. This was a first in the history of our Faculty.

The visitors stated that they were satisfied with the direction the reform had taken. In their opinion, relations with our affiliated hospitals required rationalization. They noted that significant effort had been put into promoting research. They also observed that program implementation required no new human or financial resources from the University. They indicated that there was an urgent need to increase the number of teachers.

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*Recommendations from the LCME-CAFMC accreditation visit*

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- Students, often encouraged by the tutors, tend to set learning objectives that are broader than the essential knowledge to be covered. Develop strategies to curb the obsessive tendency to cover everything.
  - Basic sciences have been integrated into clinical sciences in the problems. Demonstrate that the students have mastered the fundamentals of the basic sciences.
  - Reduce the size of the tutorial groups to less than ten students.
  - Continue working to train tutors in their new roles as learning facilitators and evaluators.
  - Develop and implement an evaluation protocol to measure and facilitate tutor pedagogical interventions.
  - Offer students additional teaching and learning methods. Encourage the teaching staff to develop evaluation methods that are consistent with the learning process. Emphasize the evaluation of student performance during tutorials.
  - Maintain the practice of internal and external reviews, even though the ongoing program evaluation process is impressive.
  - Review the admissions process from the standpoint of problem-based learning promoting self-directed learning.
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The joint accreditation committee required that we file a progress report in December 1991 responding to the following items:

- Evaluation of the new program, specifically, the results obtained by students in the basic and clinical sciences, self-directed learning, and resident performance. They also required that we comment on the results on the Qualifying Examination of the Medical Council of Canada.
  - Initiatives taken by the Faculty to increase the number of teachers involved in implementing the new program.
  - The availability of student services as well as the number of medical monographs and journals available at the library.
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Generally, a faculty takes action on recommendations during the accreditation period, in this case, seven years. But the impact of these recommendations on the Faculty was immediately felt, specifically in the area of tutor training and the development of evaluation methods such as the structured oral examination and the objective structured clinical examination. The admission process, however, has not been modified yet (See Chapter 13).

#### *External formative evaluation in October 1994*

During the April 1989 accreditation site visit, the Faculty committed to undergoing external formative evaluation after the graduation of the first class of students from the new program. In October 1991, we opened our doors to an international team of evaluators comprised of L. J. Kettel, director of the research program on changes in medical education of the Association of American Medical Colleges; C. Boelen, Chief, Unit of Educational Development of Human Resources for Health, Division of Development of Human Resources for Health at WHO headquarters in Geneva; H. S. Barrows, Vice Dean Education and head of the Department of Medical Education at Southern Illinois University, United States; G. Bordage, head of the master's degree program in health-sciences education at Laval University, Quebec City, Canada; and H. Schmidt, from Maastricht University (the former University of Limburg), Maastricht, Holland, and former Associate General Secretary of the Network: Community Partnerships for Health through Innovative Education, Service, and Research.

This time, the objectives were quite straightforward: assess the preclinical training reform four years after its implementation. Over a period of two days, the visitors met with program heads, unit heads, groups of tutors, and many students. They attended tutorials and studied unit handbooks, tutor guides, and written examinations. They evaluated self-directed learning, humanism, community rotations, the Sherbrooke PBL model, consistency between tutor training and teaching activities, and congruence between the values conveyed by the new program and the mission and goals of the Faculty. We were rewarded with very high praise.

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#### *General observations*

1. Teachers open-minded. Students and teachers enthusiastic. Documents clearly written. Teaching tools and tutor guides of high quality.
  2. A unique, remarkable, and successful undertaking by the University of Sherbrooke, which, in a relatively short period, switched from a traditional curriculum to a student-centered program based entirely on problem-based learning. According to the evaluators, "This may be the best way to successfully implement a major change".
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3. Consistent with the initial objectives. Widespread acceptance of the underlying philosophy. Will to continue working and a feeling of belonging.
4. Congratulations on having involved the greatest possible number of teachers in the change process. Effective management demonstrated in terms of coordination and on the level of the units. Participation of the entire Faculty with an outstanding degree of consensus and decision-making that consistently follows the bottom-up model. Implementation planned out step-by-step, making the change easier for students and teachers.
5. Complete switch by the entire Faculty, including teachers and students, to a new educational process in which the concepts of problem-based learning and small-group work have been mastered.
6. Current success and a general desire to pursue the changes has created the momentum needed to explore new avenues and to maintain interest in seeking out other innovative approaches.

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A response was not long in coming, since the Faculty was redefined (Faculty of Medicine, University of Sherbrooke, 1993) and the Faculty Development Office was transformed into the Medical Teaching Center devoted to research. This step preceded the creation of a department of medical education. Moreover, the recommendations concerning the evaluation of learning and building PBL problems were reflected in the new version of the program as results of the Review Board's activities.

Nevertheless, the visitors suggested six improvements:

### *Suggestions for improvement*

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#### **1. Evaluating Learning**

The teaching staff appears to try to lead learning, which tends to cause program rigidity. The students do not seem to benefit from the spirit of discovery that drives the PBL method. The program, which should be student-centered, has been far too structured by the teachers, as evidenced by problem structure, the very specific objectives, and the very elaborate *Tutor Handbook*. Even the pages in the reference material are provided. Some tutors explicitly direct learning in very specific ways. Such contexts inhibit students from learning at their own pace. The system should be "broken open". It is a question of attitude on the part of the teaching staff who must demonstrate greater confidence in the learning ability of their students. Inevitably, the mechanisms for evaluating learning must also be reviewed.

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## **2. Medical Biology Unit**

Basic sciences should be integrated throughout the program. The PBL units must be restructured; basic science teachers must be invited to take a greater role and even to direct several PBL units. Optimizing problem-based learning requires that basic science teachers contribute to each and every unit in the preclinical phase.

## **3. Building PBL Problems**

The way that PBL problems are written should be reviewed to provide a more accurate simulation of clinical realities, such as presenting the problem in the patient's words. More and better use should be made of visual aids. The problems should facilitate the discovery of critical elements, the creation of hypotheses, and the development of personal study objectives in the basic sciences.

## **4. Community-Oriented**

The implementation of the "community-centered" facet is judged more on the program process than on the product and its outcomes. The types of desired impacts and specific services that this orientation should bring about should be described in. One would expect the Faculty of Medicine at the University of Sherbrooke to find solutions to community-oriented problems on a larger scale than its MD program.

## **5. A Department of Medical Education**

The Faculty should capitalize on its outstanding knowledge and recruit professionals in the area of medical education. The department of medical education should be focused on research in medical training, while contributing to teaching and specific services, such as test evaluation, program development, and so on.

## **6. Faculty Development**

The Faculty's mission and goals should be reviewed. The evaluators feel that they have identified inconsistencies between the educational goals and the social mission, which must respond to the new needs of a rapidly changing society.

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### *Report from the program committee in February 1993*

In September 1990, a Program Committee under the Vice Dean Education was created comprising six teachers, two students, and a teaching consultant. The committee was mandated specifically to find a positive answer to the following question: Are the teaching and learning activities of the new program consistent with the major orientations adopted by the Faculty, specifically: student-centered, problem-based learning built on small-group tutorials, designed to train physicians to be autonomous learners and to demonstrate humanistic behavior and a genuine concern for the community?

The Committee met for two years. It questioned the heads of PBL units in the preclinical phase, and discussed what orientations and means might be recommended with respect to

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the question. According to the Committee's report, submitted in 1993, nearly all the unit heads had bought into the major orientations as well as the modifications to methods and learning activities. A very large majority of the teaching staff appeared to be "favorable" to the reform and participated in it in a "more or less active" manner. Nevertheless, there were still "islands of indifferent or intractable faculty members".

The report also presented observations on the three main orientations of the program: humanism, community orientation, and self-directed learning.

### ***Program orientations***

#### ***Humanism***

"For the moment, we cannot consider that this objective has been achieved, nor has it become a distinctive characteristic of our program." According to the Committee, if we are to maintain this orientation, we must:

- Define humanism in terms of attitudes and behaviors required to competently practice medicine; work to build a unified understanding of this program feature among the teaching staff; present humanism to the students as being an objective to be gradually achieved over the course of the program through a set of educational means strategically arranged for this purpose.
- Encourage the teaching staff to practice these humanistic attitudes and behaviors in their earliest contacts with students during tutorials and other activities.
- Clearly state that the tutorial is not solely a cognitive learning experience, but also a valuable opportunity for developing and demonstrating humanistic behaviors. Consequently, the Faculty should develop strategies to equip teachers with tangible means for achieving this goal.
- With respect to humanism, the example set by the teaching staff, especially through daily verbal and nonverbal behavior, is more powerful than any didactic lesson in this domain.

Although the Faculty emphasizes excellence in teaching, it would do well to likewise officially recognize humanism in its teachers in order to stimulate them to serve as role models for the students.

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*Community-oriented*

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The Committee took note of activities pertaining to community orientation: the choice of PBL problems, and the clinical immersion rotation, the PBL community rotation, and the rotation in family medicine, community health, and primary acute-care.

"This concern should be more fully integrated in the great majority of our teaching and learning activities. We hope that the members of the Department of Community Health Sciences for the University of Sherbrooke's Department of Community Health would influence each of the program's units in components. Equally important, the characteristic behaviors of a community-oriented physician should be clearly defined, methods should be developed to measure the acquisition of these behaviors, and strategies should be designed that will our students to progressively develop this community-oriented view of medicine throughout their training.

We also feel that strategies should be developed to make their students more aware of the realities of practicing medicine in a hospital setting and of the prevention. In addition to being welcome on the political level, clinical teaching that takes into account the province's physical and human resources and which focuses on disease prevention as well as on the risk-benefits and cost-benefits relating to diagnostic and treatment interventions would constitute an enviable feature of our program. In this concern for the community should also be mapped onto both basic and clinical research."

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*Self-directed learning*

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"Currently, it appears that only those activities that take place in the community, that is, the clinical immersion and PBL community rotations, and perhaps certain activities in unit 14, promote the development of self-directed learning.

Perhaps it is unreasonable to expect complete learning autonomy at the undergraduate level. Nevertheless, the objective of inculcating in our students the ability to identify their own training needs, to work to fulfill them, and then to evaluate whether they have achieved the goals set should be targeted by specific learning activities at the undergraduate level. Tools enabling the acquisition or realization of a certain degree of autonomy must be developed and used strategically and at increasingly higher levels of requirements and behaviors to be acquired throughout the MD program."

As a result of its deliberations, the Committee formulated comments related to problem-based learning, working in small groups, and centering the program on the student.

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### *The means*

**Problem-Based Learning:** "The main preoccupation in the PBL process revolves nearly exclusively around objectives and content." Action should be taken to increase teacher interest in the teaching dimension of their task. The Committee suggested that they be assigned specific financial and human resources. Finally, because PBL is based on recalling previous learning and on organizing new knowledge, the Committee recommended that tutors have an overall grasp of the program in order to better position their interventions and help the students to integrate them.

**Small Groups:** The format of tutorials, which students find motivating, is highly structured; the roles of each player being maintained from one unit to the next. Since the students pursue individual rather than common objectives, the Committee proposed that the rationale underlying these small groups be expressed more clearly in terms of group work rather than psychosocial relations. Furthermore, they recommended that "short but systematic training in feedback and group leadership be provided early on to students to better equip them for functioning in a group".

**Student-Centered Program:** Students have gone from being passive listeners to taking a more active role in determining their learning objectives and in building their knowledge base. Nonetheless, the degree of latitude and freedom in determining learning objectives is far from ideal. Current evaluation methods bear much of the responsibility for this. "Frequent, topic-based summative evaluations have more or less turned what had been idealized as a student-centered program into an examination-centered program." The Committee wonders about the consistency between evaluation practices and the teaching targets.

The Committee concluded its report by stating that "our program's learning activities are, for the most part, consistent with the orientations adopted by the Faculty when the new program was implemented". The Committee offered a number of recommendations.

### *The recommendations*

- Define humanism, community orientation, and autonomy in terms of the knowledge, skills, and attitudes required to competently practice medicine.
- Establish a progress plan for our students relating to the mastery of knowledge, skills, and attitudes; plan learning activities designed to achieve them.
- Develop methods for evaluating humanism, community orientation, and self-directed learning in order to verify that the objectives in each of these areas have been achieved and to confirm that students and the teaching staff alike deem them important.

- Revise the current evaluation model so that its rigidity does not become an impediment to the cognitive development of our students and to the acquisition of self-directed learning behaviors.
  - Point out the relevance of working in small groups.
  - Strengthen training in group leadership and providing feedback in order to optimize small-group performance.
  - Set up a structured teaching assistance program to help students with problems achieved autonomy in learning.
  - Round out the general training that the Faculty teaching staff has already received, with emphasis on the pedagogical principles on which PBL is founded and on metacognition.
  - Provide tutors with an overall view of the MD program.
  - Equip tutors with tangible means for promoting the development in students of autonomy, community orientation, and humanism.
  - Reaffirm the role of unit heads so that they realize that they have real authority in terms of the development and administration of their units.
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The Committee concluded that implementing these recommendations would require "additional efforts" in terms of personnel and funding. In fall 1993, a Review Board was established to develop proposals for a revised version of the program in spring 1994.

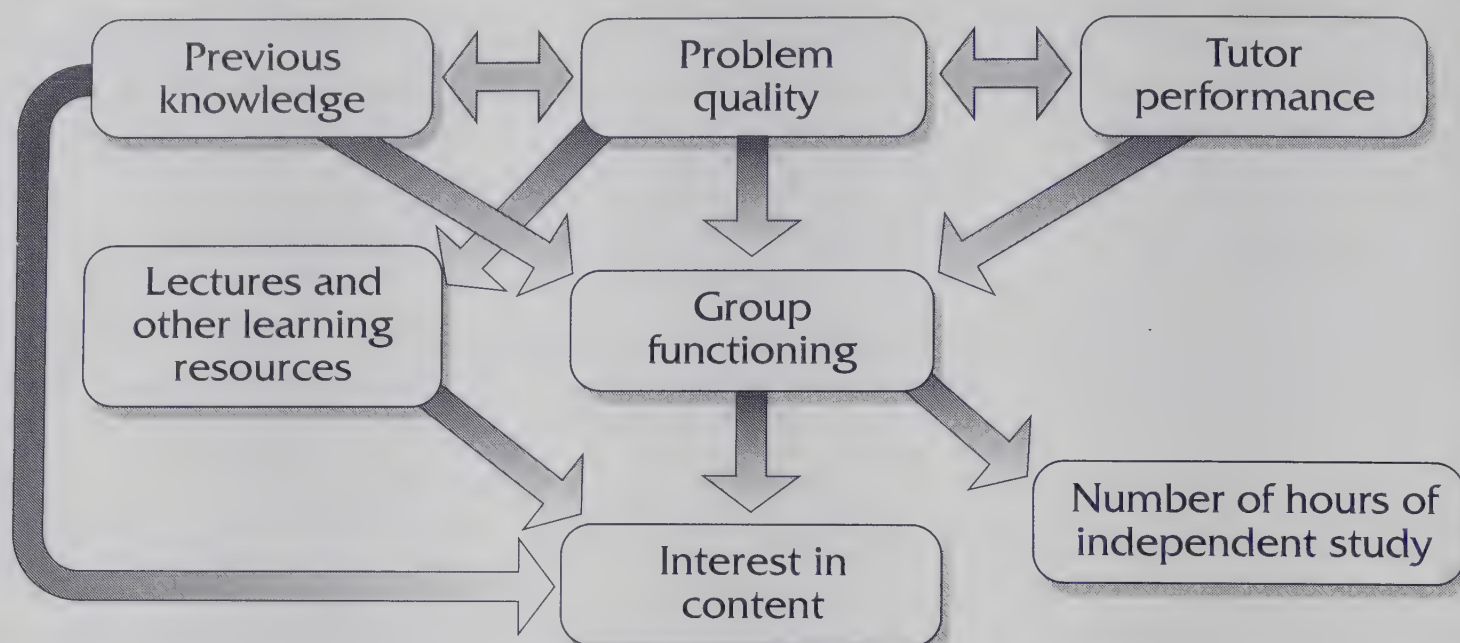
#### *The outcomes of PBL unit assessments by the students*

In summer 1987, thanks to Professor Henk Schmidt, we were able to make use of the PBL units assessment questionnaire developed according to the Gijsselaers & Schmidt theoretical model (Gijsselaers, 1990). Student prior knowledge, problem quality, and tutor performance back significantly on how the group functions. How the group functions, as with other learning activities, influences student interest in and time devoted to the material (See Fig. 1).

Students fill out the questionnaire at the end of each unit. This ongoing assessment tool enables us to correct any flaws in the PBL units. The version used in Sherbrooke (Black et al., 1992) since 1990-91 contains 32 items, 22 of which have been taken from the Maastricht questionnaire. Each consists of a statement (See Appendix I) that the student must rank according to a Likert-type scale, ranging from "completely agree" (5 points) to "completely disagree" (1 point).

The rate of response from 1987 to 1992 varied from 71% to 96% for the first year of the program and from 57% to 97% for the second. The rate significantly dropped, however,

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\* adapted from Gijsselaers and Schmidt (1988)

Figure 1. Causal model of factors influencing problem-based learning

in 1991-1992. During that period, questionnaire administration involved the tutorial stewards. The Faculty then announced that, upon admission, students were obliged to participate in the various program evaluations. The registrar would not issue the transcript until the student had handed in his or her completed questionnaire. The current rate of response is 100%.

The questionnaire deals with all first- and second-year PBL units, with the exception of the Introduction to Learning Methods unit, the human sexuality course, and the longitudinal clinical skills learning unit. This type of evaluation provides two types of information: feedback and a profile of each of the units, along with an individualized profile of each tutor; and comparative analysis between different years based on factors relating to the questionnaire's scope.

### Unit Profile

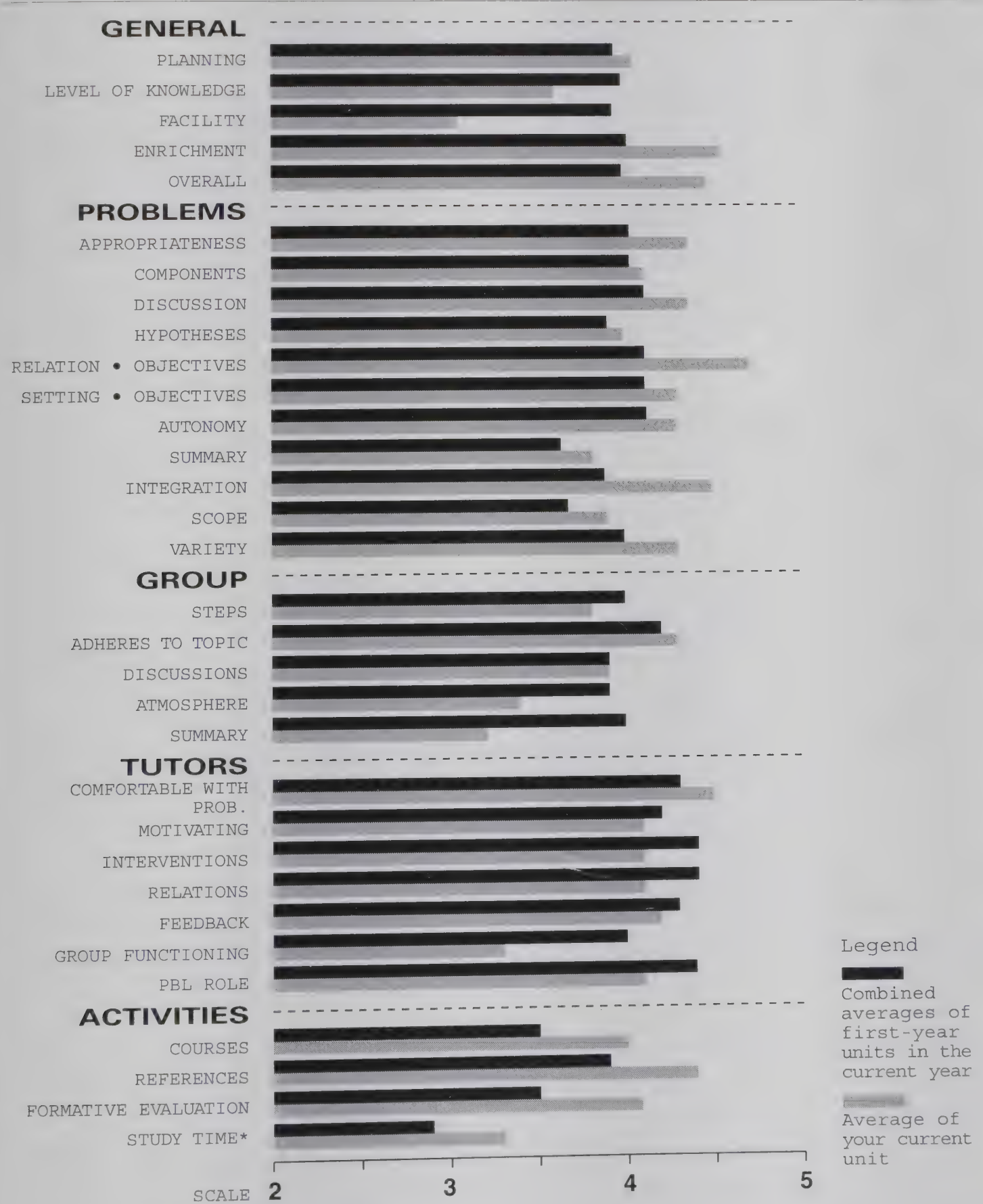
The unit head receives the profile at the end of the unit. Table II compares, based on 32 factors, the performance of a first-year unit to the average performance of all first-year units in the current academic year. Note that this unit has been ranked higher for planning and enrichment as well as overall. Differences can also be seen in problem quality, tutor performance, and so on. Students have rated this unit very high. Performance was lower, however, in terms of climate and group functioning (See Table II).

This allows unit heads to compare their teaching performance to that of their peers in the same year of the program. For the moment, tutors are solely responsible for taking action to modify aspects that fall below expectations.

Tutor feedback

Each tutor receives the unit profile and his or her own profile at the same time. Table III provides two examples of tutor profiles. The performance of Tutor A is quite higher than that of his or her peers in six of the seven areas measured; three received perfect scores.

Table II. Sample profile for a first-year unit



\*Average of 33 to 43 hours per week

In contrast, Tutor B has been ranked patently lower than his or her colleagues. Both cases include ranking on student satisfaction with respect to the tutor’s functioning in the group and the unit in general in relation to the average given to the tutor.

Table III: Profiles of two PBL tutors

PROFILE OF A LESS THAN AVERAGE PBL TUTOR				PROFILES OF AN EXCELLENT PBL TUTOR			
	Unit Average	Your Average	Relative Deviation		Unit Average	Your Average	Relative Deviation
Comfortable with topics	4.1	3.9		Comfortable with topics	3.8	5.0	**
Encouraging during work	3.8	2.6	**	Encouraging during work	4.1	4.8	*
Stimulation and interventions	4.0	2.7	**	Stimulation and interventions	4.1	5.0	*
Relations with students	4.2	3.6	*	Relations with students	4.3	4.8	*
Feedback to students	3.9	3.3	*	Feedback to students	4.2	4.8	*
Evaluations on group functioning	3.6	2.3	**	Evaluations on group functioning	3.7	4.3	*
Overall, tutor role	4.0	2.4	**	Overall, tutor role	4.1	5.0	*
Student standpoint				Student standpoint			
Functioning in the group	3.8	3.0	*	Functioning in the group	3.9	4.0	
Unit evaluation	4.1	3.9		Unit evaluation	3.6	3.3	

From 1987 to 1994, the student assessments were sent directly to the Faculty’s examination assessment office. A statistician prepared the various profiles for the Vice Dean Education, who sent them confidentially to each tutor. No one else had knowledge of a tutor’s profile, including the Program Director, the Coordinator of Preclinical Training, and the head of the tutor’s unit. Since that time, tutor profiles have been stored at the program office, where they are available for consultation by the heads of the specific units, but only in the presence of the Program Director or the Preclinical Coordinator.

In recent years, some profiles have clearly shown improvement. Tutors, sometimes judged harshly by students, develop their own pathways to improvement. Tutors may also take advantage of an observation and mentoring service (See Chapter 9). Although certain profiles have occasionally worsened, no administrative action has yet been applied.

*Tutorial assessments*

The 32 assessment items for PBL units have been converted into an equal number of factors based on analyses covering a number of years (Black et al., 1992) (See Table IV and Appendix I).

A number of interesting phenomena become evident when the factors are compared among themselves and from one year to the next:

- The five factors pertaining to groups always correspond to the average.
- Factors relating to the tutors are always the highest ranked.
- The knowledge factor (the tutor is comfortable with the subject matter of the problems) has consistently remained, through the years, the single, highest-ranked factor.

- In 1992, lectures ranked in the average, whereas, in the four preceding years, they were nearly always in the top position.

These assessments help us to draw up progress summaries for specific years and even yearly profiles.

Table V depicts the average of factors for all second-year units in 1991-1992. It reveals a number of interesting points:

- Lectures almost ranked in the top third of the factors.
- In 1990-1991, the subject was seen as being the easiest element. This factor, ranked second, fell to last place the following year.
- On the whole, the factors hold the same positions from one year to the next, with the exception of some sporadic variations that are difficult to account for. To illustrate, the «enrichment» factor, which normally comes in around the average as shown above, came in last place in 1990-1991.
- Formative evaluation and the assessment of group functioning by tutors consistently rank low.

Although these general data provide an overall picture of the program, they are of little practical use for units and program heads.

Table V. Average of the factors for all second-year units in 1991-1992 (in ascending order)

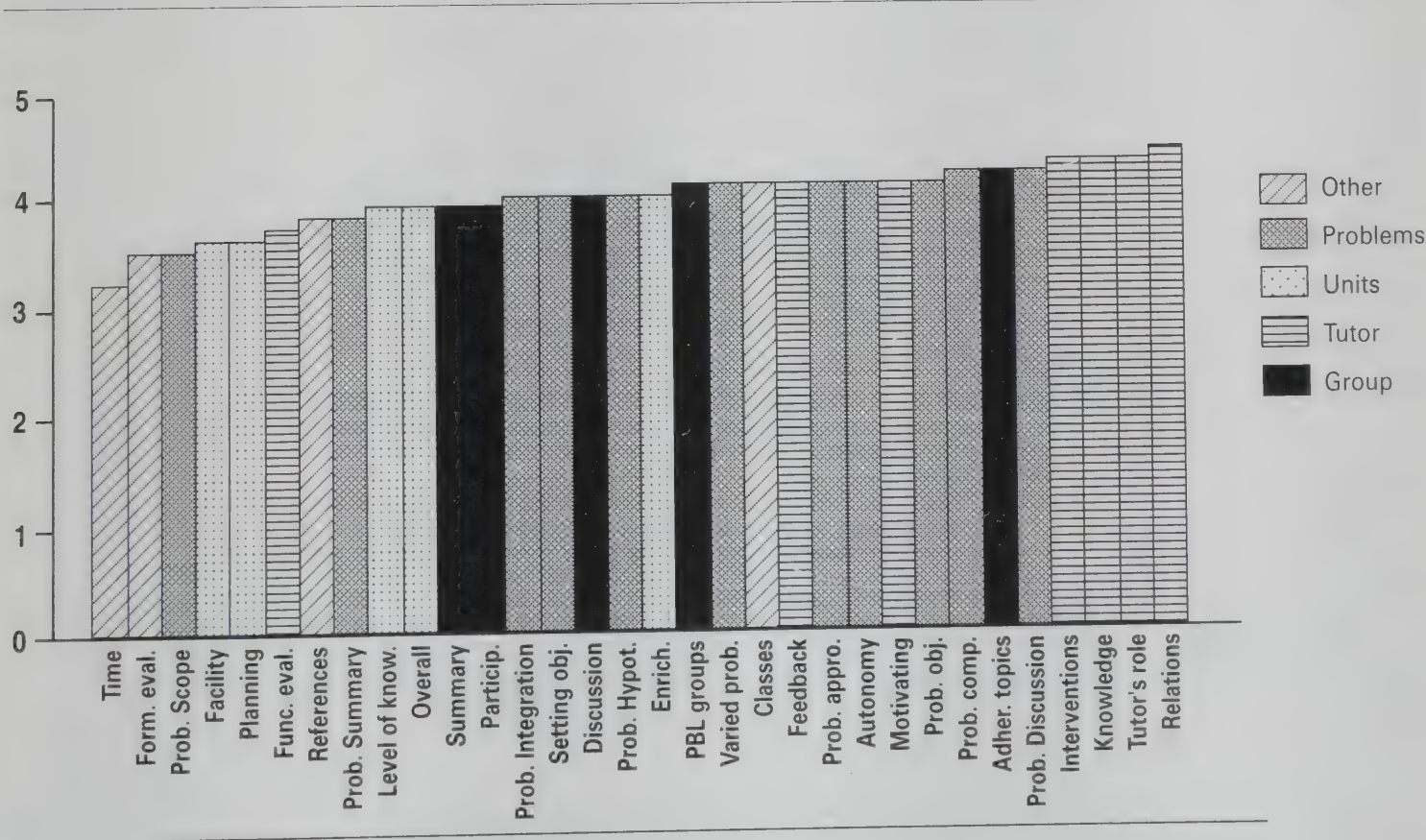


Table IV. The 32 individual assessment factors for PBL units

FACTORS	CORRESPONDING ITEMS
A. GENERAL IMPRESSION OF THE UNIT	
1. Planning 2. Level of knowledge 3. Facility 4. Enrichment 5. Overall	The breakdown of work during the unit was well planned. The material in the unit was appropriate for my level of knowledge. The material in the unit was easy to understand. I learned a lot because the unit was interesting. I would give this unit an overall rating of excellent.
B. PROBLEMS	
6. appropriateness 7. Components 8. Discussion 9. Hypotheses 10. Objectives 11. Setting objectives 12. Autonomy 13. Summary 14. Integration 15. Scope 16. Variety	The problems were clearly stated and it was easy to apply Problem-based Learning to them. Defining problem components was easy. The problems adequately stimulated group discussions. Developing hypotheses was easy. The problems correlated adequately to unit objectives. Setting objectives was easy. The problems adequately stimulated self-directed learning. Summarizing the explanations was easy. The problems helped me to integrate basic and clinical sciences. During the unit, I learned many things that were not related to the problems themselves. There was an adequate variety of problems.
C. GROUP PROCESS	
17. PBL group sessions 18. Adherents to topics 19. Discussions 20. Participation 21. Summary	My group systematically applied the steps in the PBL process. After reaching a consensus, the members of my group met their commitments relating to learning issues. The discussions during tutorials were productive and stimulating for my self-directed learning activities. The atmosphere in my group was pleasant and everyone took an active part. Producing the group summary was easy.
D. THE TUTOR	
22. Knowledge 23. Motivating 24. Interventions 25. Relations 26. Feedback 27. Assessment of functioning 28. Tutor's role	The tutor appeared comfortable with the topics dealt with in the problems. The tutor encouraged us to work hard. The tutor's questions stimulated discussion and his/her interventions were pertinent. My relations with the tutor were good. The tutor gave me feedback during the formative evaluation. The tutor assessed group functioning with us at regular intervals. Overall, the tutor performed his/her role.
E. OTHER LEARNING ACTIVITIES	
29. Classes 30. References 31. Formative evaluation 32. Study time outside tutorials*	The lectures were pertinent, coherent, and well-presented. The recommended references were well-selected. The formative evaluations helped me to better direct my learning. The average number of hours spent per week on independent study.

\* A different scale (shown below) was used to rate this factor:

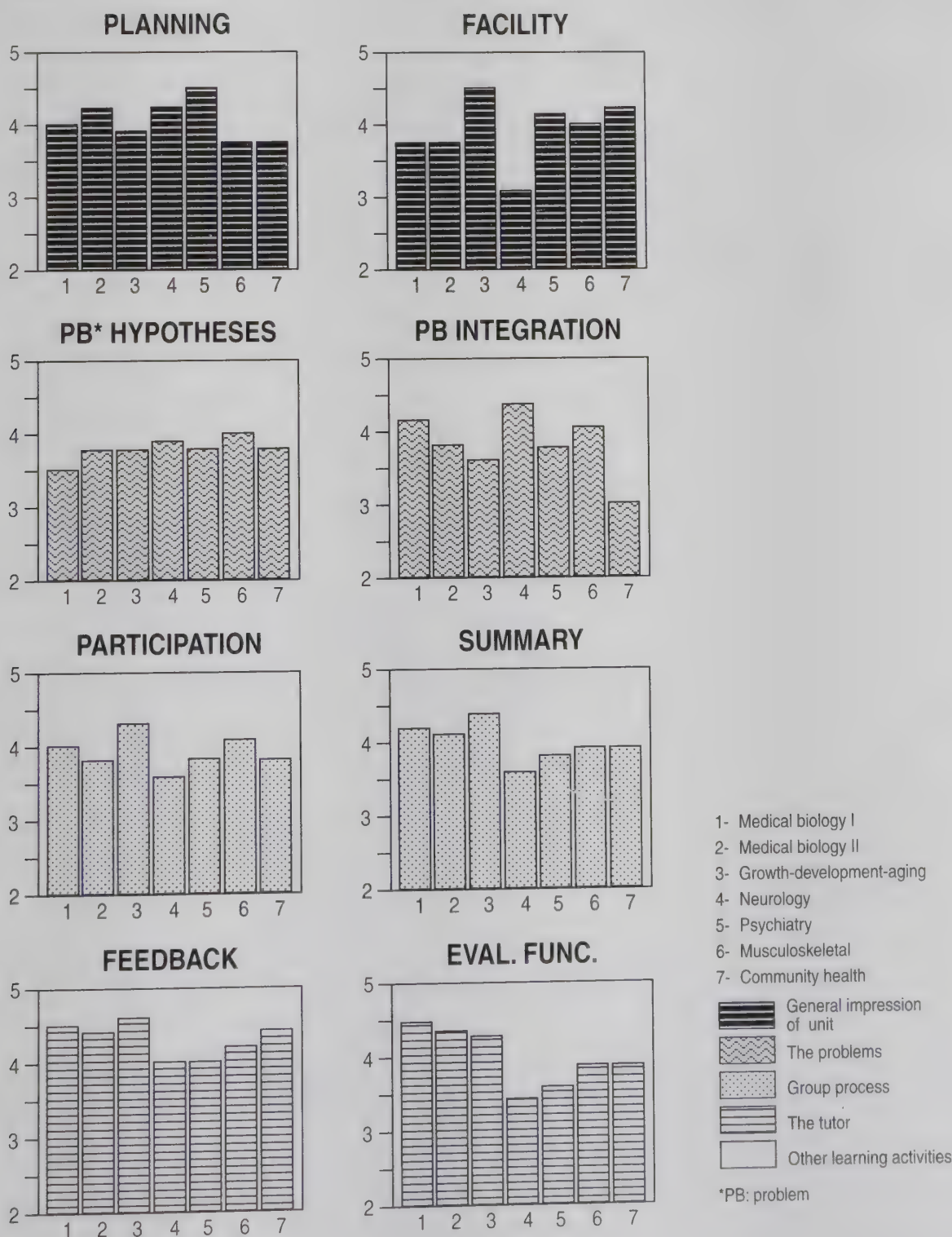
A	B	C	D	E
<20	20-30	30-40	40-50	>50

Comparing units

The compiled data can also be used to compare units and to build specific profiles for each. These profiles can be used systematically, especially after meeting with the stewards, to confirm or to disapprove subjective perceptions on the part of the program administration.

To illustrate, let us take a look at 8 help of the 32 factors for first-year units in 1990-1991. Two reflect the overall impression of the unit, planning, and facility; two with the quality of problems, developing hypotheses, and integration ability; two with the group process, participation, and summary; and two with the tutor's role, feedback, and assessment of group functioning (See Table VI).

Table VI. Profile of first-year units (1990-1991) based on five factors



The data in Table VI gives rise to the following observations

#### Overall impression of the unit

- Planning: the psychiatry unit is the best planned, closely followed by Neurology, and Medical Biology II. The remaining units are deemed less well-planned.
- Facility: the neurology unit is considered the most difficult, followed by both biology units. The growth-development-aging unit was ranked easiest.

#### The problems

- Hypotheses: most of the units have fairly similar profiles, with the exception of Medical Biology I, which is NOT very revealing, and the musculoskeletal unit, which appears to lend itself to generating hypotheses.
- Integration: Neurology, Musculoskeletal, and Medical Biology I promote knowledge integration, whereas the community-health unit does so to a much lesser degree.

#### The group process

- Participation: participation appears to be relatively easy in all units, except for Growth-Development-Aging (in which it is easier) and Neurology (in which it is harder).
- Summary: this aspect is much more difficult in the neurology unit and less so in Growth-Development-Aging.

#### The tutor

- Feedback: tutors provide less feedback during the neurology and psychiatry units. Students feel that they receive the most feedback during Growth-Development-Aging and the two medical biology units.
- Assessment of group functioning: students feel that this is less successful in the neurology unit, but much more so in the biology units and Growth-Development-Aging.

These comparative unit profiles are of significant value in maintaining objectivity, standardizing comments, and weighting the opinions of stewards. At year end, the program heads determine which aspects should be improved. The average number of hours spent per week on independent study-heads determine which aspects should be improved. The Preclinical Training Coordinator and unit heads discuss them with a view to preparing the next version. It should be easy to see that maintaining the validity of the program assessment process depends on getting a high rate of response on the individual assessments of PBL units.

#### *Unit profile*

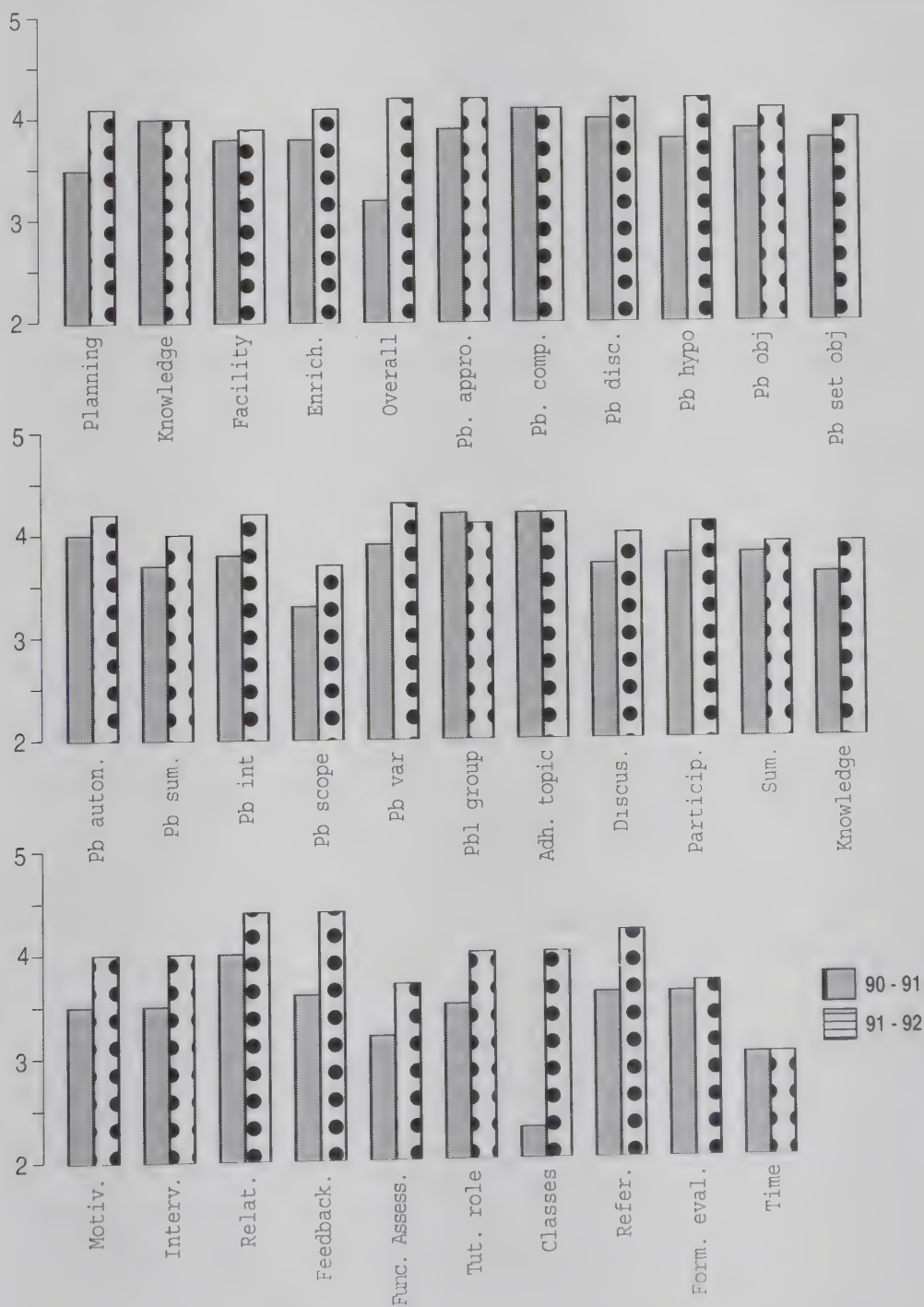
One might think that a group of tutors and the head of a specific unit would strive to offer about the same level of performance from one year to the next. But what effect would changing the unit head have? Looking at the 1990-1991 and 1991-1992 profiles for a particular unit might shed some light on this question (See Table VII).

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In 1991-1992, certain problems in the overall functioning of the hematology-immunology unit were eliminated. A teacher set about improving unit planning; teaching methods, including lectures and references, were also reviewed. The outcome of the assessment indicates significant improvements: better planning, greater interest, and double the overall rating. Nearly all the factors related to the problems and group process show improvement, some more than others: tutor role, motivation, interventions, relations, feedback, and assessment of group functioning. This shows that specific action has resulted in specific improvement.

Program administrators saw in these descriptive results a confirmation of the efforts put into improvement by the teachers and the unit heads. This, in itself, provided positive feedback.

Table VII. Profiles of the hematology-immunology unit for 1990-1991 and 1991-1992



Lastly, based on these assessments, one could deduce that the PBL units ran fairly smoothly during the implementation years. The tutors were rated quite high by both first- and second-year students. The general profile that emerged provided a very valuable picture of implementation:

- Nearly half the factors-and often more-equal or exceed the average of 4, which is considered as the threshold "good rating"; none dip to 3, which is a neutral response.
- The tutors receive very high marks. The seven items specific to tutors always head the list of the annual averages, the "knowledge" factor, in particular. In contrast, assessment of group functioning consistently returns significantly lower average.
- As for the five factors relating to the group process and problems, the overall averages are quite sound at 4.
- Lastly, the number of hours of study outside tutorials - 30 to 40 hours per week - is consistently lower in first year than in second, which runs two to three hours more.

Nevertheless, some units are traditionally ranked higher than others by students. Cardiology in second year is a specific example. That was the case with the first-year neurology unit, but, in recent years, it seems to have dropped back into the pack.

There are major variations from one unit to the next and from one academic year to the next for a given unit. No unit is safe from a sudden drop in the evaluation of a factor. Generally, since unit heads pay close attention to feedback, a remedy is implemented the following year and the situation gets back on-track.

## Special Studies and Analyses

Since the graduation of our the initial cohorts, evaluation of the product has become the priority of program assessment.

### *Admissions*

Has the new program had an impact on the profile of candidates admitted to the Faculty? The study comparing the nine cohorts admitted between 1987 and 1995 to those admitted the five previous years (See Table VIII) yields a number of observations.

- Each year in May, the University of Sherbrooke holds an open house for candidates who might be offered admission to the MD program. It provides an opportunity to explain the program and to talk about the University's distinctive differences. Prior to the creation of our open house, 37% of the 200 best candidates from the province's *collèges d'enseignement général et professionnel* (general and vocational college; known as *Cégeps*, these colleges provide the 12<sup>th</sup> and 13<sup>th</sup> years of pre-university education) accepted our offer for admission. Since we instituted the open house, the average percentage increased to 56% from 1982 to 1986. Then, it shot up to 83% and 79% during the first two years of the implementation of the new program (1987 and 1988). In 1989, it dropped to 66%, before rising sharply to 95% in 1990 and to 97% in 1991. From 1992

to 1995, the portion of students coming from the Cégep network was filled before reaching the 200<sup>th</sup> candidate on a list of excellence of approximately 1900 students. In fact, in 1987, the last candidate admitted ranked 225<sup>th</sup> on the list, compared to 150<sup>th</sup> in 1995.

The findings of the study allow us to make certain deductions:

- The new program attracts Cégep candidates that perform twice as well academically as in the past.
- Although we have been attracting stronger candidates under the new program, more than 60% of them on average accept our offer of admission. Under the old program, the rate was only 35%, even though the candidates were weaker. Therefore, the new program is what attracts more students with higher academic records to Sherbrooke.
- The new program has not affected the age of candidates whether from Cégeps (19.5 years of age) or with a university background (22 years of age).
- A growing number of women are admitted to our medical program. The percentage varies from 51% to 73%, depending on the year, with an average of 61%. This phenomenon is not related to the new program, since Quebec’s other medical schools show the same trend.

Table VIII. Profiles of students admitted from 1982-1995

Year	Percentage of Enrollments		Total	% of Best 200 Cégep Students Admitted
	Men	Women		
1982	58	52	110	42%
1983	52	58	110	50%
1984	37	65	102	58%
1985	43	50	93	71%
1986	32	62	94	61%
Average	56%			56%
1987	38	63	101	83%
1988	44	56	98	79%
1989	45	55	94	66%
1990	36	64	102	95%
1991	36	64	101	97%
1992	30	70	104	100%
1993	32	68	102	100%
1994	45	52	97	100%
1995	36	56	92	100%
Average	61%			91%

\* General and vocational college

*Graduates and attrition*

From 1980 to 1985, the cohort attrition rate averaged 7.2% annually, compared to a graduation rate of 92.8%. The student most likely to drop out came from a small, remote town, alone in Sherbrooke without social-emotional support (Brazeau-Lamontagne, 1988).

From 1983 to 1987, before implementation of the new program, the graduation rate held at 90% on average. Afterwards, it began moving upward with an average rate of 94% for the first five years (See Table IX).

Table IX. Comparison of graduation rates between the old and new programs

	%	Average
Old Program		
1984 - 1988	93.1	89.7%
1985 - 1989	88.2	
1986 - 1990	87.9	
New Program		
1987 - 1991	93.0	93.8%
1988 - 1992	94.9	
1989 - 1993	96.0	
1990 - 1994	89.0	
1991 - 1995	96.07	

During the last three years under the old program, there was at least one expulsion per year (for a total of four), two repeats, one late, and 26 withdrawals. Academically weak students usually tend to withdraw. Under the new program, we had only three expulsions, but nine students late in completing a year, 14 repeats (including eight in second year for the cohort of 1988-1992), 16 instances of academic leave, and only nine withdraws.

The overall conclusion is that the new program allows students to overcome their difficulties (academic and otherwise) and to learn their MD degrees. The new system offers a more relaxed attitude towards repeats, academic leave, and late completions. At least, the program's directors and administration feels that the program is more humanistic, liberal, and flexible.



The Class of 1991: our first cohort. These are the pioneers of the new program on whom the administration was counting until their graduation. We consider them real agents of change.

#### *Final evaluation of student learning*

Assessment of student learning is the keystone in the evaluation of any educational program. While measuring all aspects of learning is difficult due to lack of appropriate instruments, the cognitive domain still predominates. This view is supported by the introduction in 1976 of the comprehensive examination of the *Conférence des doyens des facultés de médecine du Québec*. Since then, all students (at least, those in the three French-speaking medical schools) must pass the examination in order to obtain their MD degrees. Moreover, the examination counts for 30% of the summative evaluation for the year and a half of clerkship rotations at Sherbrooke. While students are not required to sit the Qualifying Examination of the Medical Council of Canada, most of them do.

The major concern of the Faculty during program implementation related to student performance on the comprehensive examination and the Medical Council of Canada's Qualifying Examination. We were impatiently waiting for the results in June 1991 and 1992. The proposal for reform presented in 1986 was premised on producing a better product. We told ourselves that our students would learn how to reason based on problems and develop greater clinical competency. At the same time, they would achieve the same

level of cognitive competence as students in the other medical schools, and perform just as well on provincial and national examinations.

The heads of the new program felt that students would need six weeks of preparation for the examinations instead of the four under the old curriculum. The first three cohorts under the new program performed about the same on the comprehensive examination as did the last three under the old curriculum. Performance on the Medical Council of Canada qualify examination (See Table XI) showed an improvement in four of the six subjects: medicine, gynecology-obstetrics, psychiatry, and surgery. The students in the new program were performing better than their predecessors from the old curriculum: only six failures compared to 23 in the last three classes under the traditional curriculum. When compared to the national average, however, there are no significant differences for the six years of the study.

Table XI. Performance according to subject in medical council of canada's qualifying examination

Subject	Year			Old Program	Year			New Program	Student Test
	1988	1989	1990		1991	1992	1993		
Medicine	61.5	64.4	62.4	62.7	70.4	63.2	67.5	67.0	*
Gynecology/Obstetrics	66.6	72.0	72.6	70.3	75.0	73.1	72.9	73.7	*
Pediatrics	67.9	69.2	62.1	66.3	69.1	64.7	67.3	67.0	NS
Community health	63.2	64.0	66.0	64.4	64.5	60.9	65.2	65.2	NS
Psychiatry	58.1	62.3	62.8	61.0	68.4	66.9	69.1	69.1	*
Surgery	68.1	70.2	71.3	69.8	77.4	68.8	72.9	72.9	*
<b>Total</b>	<b>64.3</b>	<b>67.1</b>	<b>66.2</b>	<b>65.8</b>	<b>70.8</b>	<b>66.2</b>	<b>70.4</b>	<b>69.1</b>	<b>*</b>

\* Significant when  $p < 10^{-4}$

### *The attitudes of graduates*

In order to determine if the new program was meeting its objective of developing a health-care approach centered on the patient, a preliminary study was carried out to compare the professional attitudes of the graduates of the new program with those trained under the old curriculum. The survey was carried out immediately after they received their MD degrees, that is, at the start of their graduate training. We wanted to determine if residents trained under the new program would be inclined to place greater emphasis on a comprehensive approach to health care.

These attitudes were measured with a self-administered questionnaire. The method was strictly controlled (Béland et al., 1991). Seventy-four percent of 124 graduates responded. The rate of response among graduates of the old program was 65.6%, compared to 83.3%

under the new program. The questionnaire was designed to measure perception of physician-patient relations, the general orientation of care (disease-oriented or patient-oriented), patient education, psychological factors in patient care, health counseling, multidisciplinary approach, and how they viewed their teachers as role models in these areas.

The two cohorts were identical in terms of age, gender distribution, educational level, and life experience with disease. The six scales analyzed have reliability (Cronbach) coefficients ranging from 0.63 to 0.67. The results of the study are very interesting. Graduates from the new program appeared to place significantly more emphasis ( $p < 0.001$ ) on the role of the physician, a patient-centered approach to health care, and multidisciplinary (See Table XII). No differences were noted between the groups in terms of the psychosocial aspects of health care, patient education, prevention of tobacco use, and technical aspects.

Table XII. Attitudes of graduates from the old (cohort of 1990) and new programs (cohort of 1991)

	Cohort of 1990 (N = 59)	Cohort of 1991 (N = 65)	P value*
Importance of the physician's role of as caregiver/expert	3.10	3.80	0.001
Health care centered on the patient/disease	2.47	4.81	0.001
Multidisciplinary	-0.80	0.72	0.001

\* P value statistically significant when  $< 0.05$

As shown in Table XIII, students from the new program deemed that their teachers were more inclined towards interpersonal aspects in physician-patient communication ( $p < 0.001$ ). Moreover, they also felt that their professors were more centered on disease, which appears paradoxical at first glance.

The results are encouraging. The new program's orientations - student-, community-, and patient-centered - seem to have had a positive impact. Our graduates, at least those in the first cohort, tend to see the physician as supporting the patient. They promote a multidisciplinary and team approach. Lastly, they appreciate the emphasis that their teachers put on physician-patient communication, even if they feel that their teachers are more centered on disease than on the patient in their caregiving role. Could one conclude that the teaching staff itself has been positively affected by program orientations? Or

perhaps the students have a skewed perception? Although these preliminary results need to be validated, they do reveal a positive trend, with the exception of the strong focus on science observed in the teachers.

Table XIII. Opinions of graduates from the old (cohort of 1990) and new programs (cohort of 1991) on the attitudes of their teachers

	Cohort of 1990	Cohort of 1991	P value*
Interpersonal aspects physician-patient communication	-0.02	0.51	0.001
Role of the physician centered on the patient or disease	4.06	2.65	0.001

\* P value statistically significant when < 0.05

Frame of reference

The challenge in program evaluation is choosing a frame of reference that takes into account the essential aspects of the reform, the needs of the institution, and the sociocultural context of the community. In 1970 (Holzemer, 1976), a three-component analysis grid (inputs, process, and outputs) based on the well-known Scriven model (Scriven, 1967) was proposed. The inputs correspond to the group of students, the teaching staff, program goals and objectives, the costs for funding the system, and so on. The process deals with teaching/ learning activities, course content, student-teacher support and interaction, the administrative structure, and the like. The outputs are program outcomes, the mastery of knowledge and clinical skills, program impact on teachers and students, program influence on the number of graduates, student career choices, the profile of their professional attitudes, and system costs, and so on.

In 1990 (Friedman et al., 1990), leading Canadian and American medical educators met to determine the evaluation criteria for innovative programs. They identified six domains: psychosocial and interpersonal skills; continuing learning skills; professional satisfaction; practice skills, especially problem-solving ability; educational performance and cognitive development; and institutional concerns, including system costs. We used this grid, which is subdivided into 26 themes emphasizing program outcomes (outputs), to build our own grid of indicators for the areas in our program that we wanted to evaluate (See Table XIII).

The concept of assessing program outcomes has taken on greater importance since the Liaison Committee and the Committee on Accreditation have insisted on having these data. The trend in North America is growing, while the social pressures brought to bear on medical schools are forcing them to demonstrate their ability to respond to new health-care needs. Our grid includes inputs such as student admissions; process indicators such as the basic science content; and outcome indicators such as career orientation (See Table XIV).

This revised Kassebaum (1990) grid provides the greatest response to our institutional needs, while the Friedman (Friedman et al., 1990) is generally more appropriate for overall outcomes in the entire continuum of undergraduate and graduate training.

This focus on outcomes does not dovetail with institutional needs that emerge when implementing major reform such as ours in Sherbrooke. Initially, the evaluation process was an absolute necessity. As the program got up to speed, however, our attention shifted to the impacts and lasting effects of the reform. These impacts only become apparent though once the final modifications have stabilized (See Chapter 13). The innovative nature of a program can influence outcomes from the very start; this is the Hawthorne effect, a well-known phenomenon in education. But other impacts hold greater interest for decision-makers: university administrators, outside organizations such as the Liaison Canadian Committee on Accreditation, and society in general.

### *Sherbrooke's choices*

Program evaluation has become the standard in North America. We are accountable to many different organizations, the university, the provincial Department of Education, The Association of Medical Colleges, and, ultimately, the Committee on Accreditation and the Liaison Committee. In recent years, the concept of overall quality has strengthened this North American trend (Nadeau, 1991).

The first decision that we needed to make was whether to adopt a formative or summative approach (King et al., 1987). Our decision in favor of formative evaluation corresponded to specific questions asked during implementation. It constituted a typically reactive, empirical, and sometimes even opportunistic process taking into account available resources (as in the case of the study on graduate career choices mandated to the Maheu-Beaudoin group at the University of Montreal). Obviously, Sherbrooke did not follow the advice in the literature (King et al., 1987; Tyler, 1949; Shadis et al., 1991; Anderson et al., 1978) and did not begin systematically planning its program evaluation system at the outset.

According to Anderson & Ball (1978), program evaluation must target six major goals:

1. Evaluate needs and demands; test the design of critical elements; assess resources. This constitutes the opportunity phase. Sherbrooke carried out this process in 1985 in 1996.
2. Contribute to decisions to continue to program, to certify it, or to terminate it. Typically, this is the summative evaluation of the Liaison Committee and the Committee on Accreditation.
3. Contribute to decisions to modify the program, its content, its activities, and so on. In Sherbrooke, the external evaluator, visitors, and students Saul that the medical biology units were not consistent with PBL. This question proved quite thorny when the Program Review Board was doing its work in 1993-1994.
4. Identify indicators that support program development. Visitor workshops, student opinion, student individual unit assessments, and external formative evaluations, and

seminars carried out in Europe strengthened the program. Better performance by our graduates on national examinations has the same effect.

5. Promote the collection of data that would sway opponents. Patel et al. (1994) demonstrated that our students make better use of the basic sciences than students in traditional programs.
6. Contribute to the understanding of the fundamental, psychological, and social processes in a program. This is the goal of Chapter 13.

In evaluating a program or learning, each measurement, study, or analysis must be valid, reliable, relevant, and practicable. While our preliminary studies complied with these requirements, we still have a number of major outstanding questions.

- Will the graduates from our new program be a new breed of physicians who are better suited to society's requirements, demonstrate humanistic professional behavior, and are willing to practice in areas with fewer medical resources?
- Will our graduates show greater autonomy in residencies? Will they demonstrate greater professional commitment, clinical skills, and clinical-reasoning ability?
- Program evaluation often responds to social requirements, university interests, or the concerns of managers. Today, it cannot be disassociated from the new social contract blinding our educational institutions to the society that they serve. Since our program was developed to respond to these new orientations, evaluation must demonstrate to what degree. The reform has already influenced our Faculty's social system to the point of modifying its socioeducational culture (See Chapter 13).

The cognitive structure of students and graduates, their ability to analyze and solve problems, their mastery of professional expertise, their professional behavior and humanism, their desire to serve the community, and their commitment to a developing world of medicine are topics of great interest to those in charge of the program (Friedman et al., 1991).

## Conclusion

Pedagogical reforms must be analyzed within their specific socioeconomic-political contexts. Different situations and new questions yield different outcomes. Nevertheless, the basic principles of evaluation still apply if only the medical school, wherever it may be, is committed to fulfilling its social mission.

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Table XIV: Indicator grid for the different domains used for MD program evaluation

DOMAIN	INDICATOR	MEASUREMENT	RESULT
<b>Inputs</b> <ul style="list-style-type: none"><li>- Students</li><li>- Teachers</li><li>- Goals and objectives</li><li>- Funding costs</li></ul>	<ul style="list-style-type: none"><li>- Admissions</li><li>- Degree of attraction</li><li>- Specific training</li><li>- Definition</li><li>- Faculty mission</li><li>- Faculty budget</li></ul>	<ul style="list-style-type: none"><li>- Policies and regulations</li><li>- Proportion of best</li><li>- Review of documents</li><li>- Cost analysis</li></ul>	<ul style="list-style-type: none"><li>- Chapter 9, 11</li><li>- Chapter 8</li><li>- Chapter 2</li><li>- Chapter 10</li></ul>
<b>Process</b> <ul style="list-style-type: none"><li>- Learning activities</li><li>- Content</li><li>- Student-teacher interaction</li><li>- Administrative structure</li></ul>	<b>CURRICULUM</b> <ul style="list-style-type: none"><li>- PBL, conditions</li><li>- Quality of problems</li><li>- Clinical skills</li><li>- Basic sciences</li><li>- Clinical sciences</li><li>- Joy of learning, satisfaction</li><li>- Study time</li><li>- Atmosphere</li><li>- Coordinating Committee</li><li>- Flexibility</li></ul>	<ul style="list-style-type: none"><li>- Study themes</li><li>- Ongoing monitoring</li><li>- External visitors</li><li>- Mapping</li><li>- Problem inventory</li><li>- Medical education research</li><li>- Influence</li><li>- Task assignment</li></ul>	<ul style="list-style-type: none"><li>- Chapter 3, 4</li><li>- Chapter 12, 13</li><li>- Chapter 5, 7, 12</li><li>- Chapter 2</li></ul>
<b>Outputs (outcomes)</b> <ul style="list-style-type: none"><li>- Learning</li><li>- Clinical competence</li><li>- Residency choice</li><li>- Rate of graduates</li><li>- Career choice</li><li>- Community centered</li><li>- Autonomy</li><li>- Humanism</li><li>- Professional attitudes</li><li>- System costs</li><li>- Teaching staff</li></ul>	<b>Qualities of graduates</b> <ul style="list-style-type: none"><li>- Analysis</li><li>- Clinical reasoning</li><li>- Attrition</li><li>- Residency settings</li><li>- Practice settings</li><li>- Continuing education</li><li>- Interpersonal professional attitudes</li><li>- Time - teachers</li><li>- \$, \$, \$</li><li>- Evaluation</li></ul>	<ul style="list-style-type: none"><li>- Internal evaluation</li><li>- National examinations</li><li>- OSCE results</li><li>- First choice of residency</li><li>- Practice settings</li><li>- Clerkship performance</li><li>- Tutor profile</li></ul>	<ul style="list-style-type: none"><li>- Chapter 5, 12</li><li>- Chapter 2, 7</li><li>- Chapter 11</li><li>- Chapter 10</li><li>- Chapter 8, 9, 12, 13</li></ul>

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# Appendix I

## Student Assessment of Individualists

1. The breakdown of work during the unit was well planned.
2. The material in the unit was appropriate for my level of knowledge.
3. The material in the unit was easy to understand.
4. I learned a lot because the unit was interesting.
5. I would give this unit an overall rating of excellent.
6. The problems were clearly stated and it was easy to apply Problem-based Learning to them.
7. Defining problem components was easy.
8. The problems adequately stimulated group discussions.
9. Developing hypotheses was easy.
10. The problems correlated adequately to unit objectives.
11. Setting objectives was easy.
12. The problems adequately stimulated self-directed learning.
13. Summarizing the explanations was easy.
14. The problems helped me to integrate basic and clinical sciences.
15. During the unit, I learned many things that were not related to the problems themselves.
16. There was an adequate variety of problems.
17. My group systematically applied the steps in the PBL process.
18. After reaching a consensus, the members of my group met their commitments relating to learning issues.
19. The discussions during tutorials were productive and stimulating for my self-directed learning activities.
20. The atmosphere in my group was pleasant and everyone took an active part.
21. Producing the group summary was easy.
22. The tutor appeared comfortable with the topics dealt with in the problems.
23. The tutor encouraged us to work hard.
24. The tutor's questions stimulated discussion and his/her interventions were pertinent.
25. My relations with the tutor were good.
26. The tutor gave me feedback during the formative evaluation.
27. The tutor assessed group functioning with us at regular intervals.
28. Overall, the tutor performed his/her role.
29. The lectures were pertinent, coherent, and well-presented
30. The recommended references were well-selected.
31. The formative evaluations helped me to better direct my learning.
32. The average number of hours spent per week on independent study.

A	B	C	D	E
<20	20-30	30-40	40-50	>50

\* Likert-type scale, ranging from "completely agree" (5 points) to "completely disagree" (1 point)

## The New Program: The Student Perspective

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### Introduction

What was the new MD program at the University at Sherbrooke like for the students? Although we can't give the point of view of every student, we can provide a representative picture of the majority because 52% to 74% of them filled out questionnaires distributed to the students during the first three years of program implementation. Our assessment also takes into account data from various reports prepared by students. To that, we add our own personal experiences, both in collecting the data and interpreting them. The new teaching method adopted by the Faculty of Medicine resulted in major changes, for teachers and students alike. Some of them were easy to take; others were not. Our descriptions of the new program's strengths and weaknesses in the pages that follow convey our impressions of what we experience from day-to-day.

This radical change soon left its mark on everyone because we had to deal with it right from the very first day of medical school. The days of sitting passively and listening to the teacher were gone; we had an active role and were masters of our own learning. This is what those in charge of the new program refer to as autonomy. The transition was different for each of us. One thing is certain: it left no one indifferent. Here then is what we, the students, think about the new Problem-based Learning method, working in small groups, tutors, evaluation, learning methods, and student life.

### Choosing the University of Sherbrooke

Most of us wanted to come to the University of Sherbrooke because of its new approach to teaching medicine. During the open house organized by the Faculty for students who had

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<sup>1</sup> This chapter, written in the summer of 1990, has not been revised in order to preserve the flavor of the opinions gathered while the program was being implemented.

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received an offer of admissions, problem-based learning was presented as the way of the future. We wanted to be ranked among that new generation of physicians who would be self-directed learners.

From the first week, the adaptation was easy for two-thirds of us, but difficult for the other third. It should be obvious that, faced with this kind of change, students from traditional programs are bound to encounter rough patches. For the first time in our lives, we heard about problem-based learning. And we had to start applying it immediately! When you're used to the lecture approach, it's not easy to make a snap adjustment to the autonomy required by PBL. It's even harder when you have to deal with new living conditions at the same time: new town, friends, field of study, time management, reading in English, and adapting to university life. Everything is new. For most of us, it took a number of weeks before we started feeling at ease in this new adventure.

Autonomy, as we experienced it, was synonymous with insecurity. Without a doubt, the method makes all of us feel insecure to varying degrees. We are responsible for our learning and, despite the fact that each of us has their study objective sheet in hand, we have to learn to distinguish between what is important and secondary. That's sometimes a difficult task for people who always want to find out everything and to thoroughly explore every aspect of a question. A compulsive student would have a hard time trying not to read everything on a given subject if he or she had the opportunity to. So, we have to learn to be selective in our reading and set aside subjects that are less relevant.

Several factors give rise to our insecurity. We don't always know which references to consult. We are afraid of not covering all the material required. Often, we have to rely solely on ourselves to determine if we have studied enough, when, in the past, we were used to getting more guidance. From 1987 to 1992, we will be attending the only university in Quebec that uses this teaching approach. And to date, the new program hasn't produced its first graduates.

Despite the insecurity in engenders, the new PBL approach is also very stimulating. Part of the motivation comes from being involved in a dynamic process of exchange between students. We are learning to work by and for ourselves. The small-group meetings foster open-mindedness and communication. The problems pique our curiosity, pushing us to ask questions and to read to find the answers. We constantly thirst for learning. We're motivated because we have a common goal: understanding the problem. The frequency of the small-group meetings forces us to stay up-to-date in our individual studies so that we can follow the discussion.

## The Steps in Problem-Based Learning

Let's review the ten PBL steps and the problems that we had with them.

### *1. Defining vocabulary*

Defining the terms relating to a problem is the easiest step. We find out the meaning of unfamiliar words with the tutor's help or by looking in a dictionary (one is almost always available in the room).

### *2. Defining the problem and identifying its components*

The students can come to a consensus fairly quickly on defining the problem. The difficulty lies with identifying the problem's components. Two ways of thinking clash at this point. Some prefer to rewrite the components on the blackboard, either in chronological order or as a diagram; others would rather underline the components directly in the text of the problem.

Many see writing the components on the blackboard as a waste of time since it often involves transcribing the whole problem. It's a rather long and painful process if the problem is four pages long. On the other hand, blackboard proponents claim that the method helps them to formulate better hypotheses. The debate goes on. Each group has to decide which of the two methods is most useful for them when they tackle the problem. That's an adaptation of the method in response to small-group needs.

### *3. The hypotheses*

Developing hypotheses is beneficial because it helps us to establish connections between the various components and therefore guides us to the objectives in step 5. That's how we attempt to explain the problem. This common goal fuels our motivation and curiosity. Anyone can add a hypothesis onto those that have already been put forward.

Hypothesis development calls for reasoning and analysis, which is the cornerstone of PBL. We learn to reason and to deduce, rather than learning by rote. This is also the step in which group work and collaboration between students is the most apparent.

### *4. The diagram*

Drawing a diagram helps to summarize the hypotheses in a structured, concise, and understandable fashion in order to correlate the different components. This step also provides us with an overview of the problem and the explanations that we have put forward.

Theoretically, we have to make a drawing for every problem. What we do in practice, however, is another matter. Depending on the nature of the problem, the group decides if a diagram is appropriate or not. Sometimes the hypotheses formulated don't lend themselves to being diagrammed. Moreover, diagramming can improve our understanding

of the problem if the hypotheses are vague and the correlation between them difficult to make. Sometimes diagramming can lead to new hypotheses.

Sometimes the group doesn't get to the diagram before the second tutorial. Once we have studied the material for the problem, we're better able to synthesize the information relevant to our explanation. Developing the diagram also allows members of the group to take part actively.

Diagramming the problem therefore becomes an optional step as the program progresses. The fact that many people find this to be the most difficult step may account for it being skipped over. Nevertheless, we shouldn't forget how useful the diagram can be: if you can't diagram a problem, then your thinking about it is still too vague. And that's one more reason to diagram!

### *5. The objectives*

Formulating learning objectives is of critical importance. It's the foundation on which our independent study is built.

If the objectives are clear and precise, we can orient our research and read up on topics that are pertinent to the problem. On the other hand, objectives that are vague, imprecise, or too general lead us to read about subjects not directly related to the problem or to attempt to cover too much material, which wastes valuable time.

The tutor makes sure that the study objectives that we set agree with the objectives that the problem is supposed to be leading us towards. That's not always the case. After reviewing the subject in the second tutorial, we realize that we have missed one or two objectives. Then we are hard pressed for time to study the missed topics, because we have to begin studying for the next problem. Some of us would like the tutors to distribute the list of objectives before we go on to step 6, so that we can study exactly what we should be studying. This, however, would inevitably lead to a drop in motivation because we would know that the objectives would be given to us at the end of step 5. In any event, the group is generally able to discover the major concepts of the problem and to formulate appropriate objectives. The tutor plays a very important role in removing any confusion and in helping us to avoid losing independent-study time.

### *6. Independent study*

After formulating the study objectives, the group winds up the first tutorial and devotes a few days to independent study after selecting the pertinent references.

This is the most profitable step since it allows us to acquire new theoretical notions required for our medical training. We use all didactic methods deemed useful based on personal choice. Be that as it may, as we gain experience, each of us develops our own reference-material preferences.

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Most of us work individually, whether reading references or writing up personal notes. Some students get together in «summary groups,» in which each member takes notes on one part of the references read and makes photocopies of them for the rest. This system can save time; the students taking part claim that they can get more reading done. Others discuss the problem with peers before the second tutorial, in addition to independent study.

Some students feel that drafting personal summaries is laborious and time-consuming. They would like to see the Faculty prepare notes for each unit so that students wouldn't have to invest so much time on them. On the one hand, this would quickly dampen our spirit of initiative and autonomy. Others think that the tutorials would then be superfluous, since our we would have to do is study the notes. What's more, the PBL process leading to the formulation of study objectives would lose its relevance.

For the time being, the independent-study step is satisfactory because each of us can shape it to suit our individual preferences.

### *7. Explaining the problem*

Several days later, we meet again for the second tutorial to wrap up our explanation of the problem. This is the most valuable step after independent study. It allows us to summarize newly acquired knowledge, improve our understanding of the processes involved in explaining the problem, and to ask questions about things that we didn't understand.

This step can be tackled in a number of ways, which means that we have the opportunity to shape it according to our needs. Most first-year students take up the objectives formulated in step 5 to guide the discussion. Others prefer to follow a detailed agenda set by the leader. This is a very simple approach: based on the study objectives defined in step 5 and reading carried out during step 6, the leader draws up a detailed list of points that the students want to discuss as a group. All members are free to add or remove topics from the list. The discussion begins after the agenda is adopted. Another, much liked approach consists in reviewing the explanation of the problem. The leader rereads the problem and the group analyzes and confirms the underlying mechanisms. Sometimes the discussion engendered by a component goes beyond the framework of the problem. This method requires both a good memory and a sound understanding of the concepts.

Sometimes during this step, the group may decide to develop a diagram. Some problems naturally lend themselves to this, so the group attempts to summarize the information in a table. Another method that is much liked but used infrequently used to repeat the contents of the reading press asked. This involves mainly memory recall and personal notes; very little logic is involved. It's an opportunity for us to give each other "mini classes!" In the method is used particularly in first year, while we are still unsure about the material to be covered and unfamiliar with PBL.

Step 7 allows us to pool knowledge and to summarize the information gathered in explaining the problem. This step can be carried out in many different ways depending on the groups, problems, and member preferences. The tutor acts as resource person if none of the group members can answer the questions. Tutor interventions must be relevant and appropriate, preferably in the form of questions, unless the group asks directly for information.

Many factors go into making a tutorial interesting and constructive: good individual preparation, full participation, answers to our questions, summarizing the material rather than reciting it, a tutor that can point the group in the right direction, summarizing major concepts, and motivation on the part of all group members. On the other side of the coin, we sometimes find tutorials long and laborious for a number of reasons: getting stuck on irrelevant details, circular discussions, inadequate leadership, students in a hurry to get finished, and repeating chapters that everyone has already read.

Tutor participation during the steps is critical. A directive tutor usurps the role of the leader, which often inhibits the group. On the other hand, uncertainty can result if the tutor doesn't take part in the discussion. A discerning tutor participates judiciously according to the group's needs. The tutor must also intervene when the discussion gets bogged down and the leader doesn't appear to be able to get it started again. We like tutors to ask questions that lead us to look for the information ourselves and to think through the components of the problem.

### *8. Learning issues*

This is the step most often neglected in PBL. Since no one has ever clearly understood its meaning and usefulness, it soon gets set aside.

The purpose of the step is to identify questions for which there were no answers during the tutorial and which must be researched later. A noble goal that normally gets skipped over in practice. First of all, there's not enough time; as soon as one problem is finished, we have to move on to the next. On another level, if a question doesn't elicit a response, from either the students or the tutor, then it's probably too specialized. So then we think that it's not necessary...but that's not always the case!

### *9. Group assessment*

The group assessment is essential if PBL is to work properly. It allows everyone to express what they feel about how the group is working, the references that have been used, and the problem that we worked on. This step is almost always carried out. If all went well, it may only take ten seconds; a few minutes are needed if there were problems. This is when we discuss making adjustments to how the group works

The assessment also provides an opportunity for discussing the role of the tutor. If the tutor is present, however, we find it quite difficult to express our malaise with some of his or her attitudes. Furthermore, some tutors poorly understand the importance of this step and encourage us to skip over it by telling us "Everything went fine. Let's take a 10-minute break before going on to the next problem". Tutors should be better informed about the importance of the step and help the group to express its weaknesses and strengths.

#### *10. Personal assessment*

The personal assessment consists in reviewing the problems studied on an individual basis after the tutorial. It's a question of making a personal summary of the information gathered during the first nine steps. It provides students with an opportunity to carry out self-critique, evaluate their methods, and to review points that weren't properly covered or are still ambiguous.

One major constraint keeps some students from carrying out this process: lack of time. In fact, once a problem has been finished, we move on to the next, which discourages many of us from reviewing the previous problem. In reality, only a third of the students carry out the personal assessment. More often than not, it allows them to fill in blanks from the group discussion rather than summarize the information.

Lack of time is an inherent part of PBL and we have to learn how to deal with it!

### Working in Small Groups

Studying medicine through problem analysis: that, in a nutshell, is PBL. The method requires that we work in small groups...but learning is individual. Working in small groups therefore has a number of advantages and disadvantages.

#### *The advantages*

Most of us like working in small groups. The value is placed on student cooperation, which improves personal interaction. There are many advantages: pooling knowledge, active participation, collaboration and mutual help, self-confidence, openness, better understanding of the material, enhanced motivation, and so on. It teaches us how to work with others, and that helps prepare us for the relations that we will have with colleagues and interveners in a health-care setting. Working in small groups provides a good opportunity to grasp the subtleties in human relations, which are at the core of medical practice. It also gives rise to mutual respect between the group members and the tutor; our collective work lead us to an astonishing feeling of partnership.

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*The disadvantages*

Small groups also have a less attractive side. They can be the source of unhealthy competition between students who attempt to monopolize the tutor's attention in order to get a better grade. This situation can engender conflicts between students. The opposite can also occur: students who are shy or who have difficulty expressing themselves rarely talk during discussions. This means that they are at a disadvantage when being evaluated by the tutor.

Preparation for tutorials varies from one student to the next. Those who are less prepared cannot benefit fully from the discussion; they let the others do the work! Sometimes only two or three members read about a particular topic. They wind up discussing it while the others look on passively without being able to intervene. At times the discussion can get bogged down in details and go round and round. This is an ideal point for an effective tutor to step in.

*The leader: A challenging role*

The role of student leader is definitely more challenging than that of scribe and secretary. Some students feel ill at ease leading the discussion. Unless the leader has an overall view of freshly acquired knowledge, he or she is sometimes hard pressed to redirect a discussion that has stalled. The greatest challenge facing the leader is getting the less talkative to take part. Forcing someone to participate in a discussion can be fairly delicate, since people who are shier don't like being singled out! Student leaders realize this and usually hesitate to draw out the quieter group members.

*Changing group membership*

The optimal number of people in a group is seven or eight students. This allows everyone to have a chance to speak in a sustained discussion. We think that reconstituting the groups for every unit is beneficial for a number of reasons: it allows us to meet and become acquainted with more of our classmates; prevents monotony; helps us to learn to work with different people; avoids conflicts; increases motivation; and so on.

*Motivation*

Motivation stands out as the critical component in student learning. A number of factors enhance motivation, such as a motivated and motivating tutor, interesting topic, group dynamics, appropriate references, first- and second-year clinical rotations, and clinical skills sessions (especially patient contact). Motivation decreases, on the other hand, when the workload is too great for the amount of study time available; when objectives are poorly defined; when the tutorials are too long and unproductive; or when the group gets bogged down in details. Motivation also drops when students feel uncertain about what material to study and because of the length of the academic year (9 1/2 months).

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Many of these factors relate directly to how small groups function. This subject must be discussed during group assessments (step 9) in order to maintain motivation at an optimal level.

## Tutors

The PBL tutor plays a very important role in making the group run smoothly. He or she must be able to adapt to the students with whom he or she will be spending four or five weeks. The tutor has a multifaceted role: guiding the students through PBL steps; serving as a resource person, when necessary; and evaluating student learning.

It is crucial that the tutor play the role properly in order to act as a catalyst during tutorials. Some groups prefer having a fairly directive tutor; others want to have free rein. An overly directive tutor can inhibit the discussion. On the other hand, a «quiet» tutor can give rise to insecurity because we feel that we have to rely only on ourselves. In addition, this style leads us to doubt the tutor's competence in the subject area and his or her interest in tutorials. In such instances, the tutor's credibility suffers a great deal. A balance must therefore be struck between tutor participation and the frequency of tutor intervention.

It is gratifying to feel that the tutor is genuinely interested in the group and its smooth functioning. We view tutors that fit into the group as allies that we can count on. The qualities that we like to see in a tutor are competence, commitment, synthetic reasoning, integration into the group, and motivation for the task at hand. The tutor must be skilled in listening to students in order to help them make progress. We want tutors to guide us to the right objectives through timely interventions but without taking away from the discussion. We want tutors to help us distinguish between what is important and what is less so, especially through the art of posing stimulating questions. We also want our tutors to refrain from giving mini-lectures during tutorials. Tutors that share their clinical experiences with us are generally rated highly. This kind of attitude ties theory to practice, which increases our motivation.

We don't care much at all for tutors who direct the discussion and usurp the leader's role; who lack interest, act passively, or rarely speak; or who don't know the material. The last point opens up an old debate: some students want all the tutors to be topical experts. For example, the tutor for the cardiology unit should be a cardiologist. Others prefer to have tutors who are not experts and who won't be sticklers for less important details, especially since we have opportunities to discuss certain topics in greater depth with experts. The consensus seems to be that the tutor's specialty isn't important; his or her knowledge of the unit topic and motivation are.

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In short, we are very demanding of tutors. And we think that this is a reasonable attitude because our tutors are our only guides for acquiring autonomy in our learning. They bridge the gap between what we study and what the Faculty wants us to learn.

## Evaluation

Evaluation is part of any university degree program: we have to go through with it just like students elsewhere. Evaluation in Sherbrooke, however, is different in some ways. It's only natural that we should talk about it with interest.

### *Evaluation by the tutor*

Evaluation by the tutor represents 25% of the final grade for the unit, which is a fairly hefty. We have formative evaluation at the midpoint of the unit and summative evaluation at the end.

The summative evaluation has given rise to many debates from the new program's outset. Indeed, most students feel that it is overemphasized (25% of the final grade); two-thirds of students are completely against it. The dissatisfaction lies with the lack of consistency between tutor evaluations. Some tutors consider 70% excellent; for others, 80% is average. It's obvious then that the grade doesn't reflect our real performance with respect to the class as a whole. Rather, it represents the tutor's perception according to his or her personal scale. We feel that the evaluation criteria are too subjective.

Another shortcoming is that the formative evaluation is carried out at the unit midpoint, just two weeks after the beginning of the unit. We think that it is unlikely that a tutor can form a fair opinion after just three or four tutorials. Furthermore, the evaluation should provide us with feedback on our performance in small-group meetings, which is rarely the case. All too often, we hear that everything is going well, which isn't very useful, or just that we should be participating more, without more details. But what more could a tutor tell us after just two weeks? The tutor is caught in the same snare with this type of evaluation. We hear the same thing from one unit to the next, but no connection is made with the formative evaluation from the preceding unit. The grade given for the summative evaluation is usually the same as for the formative evaluation. Does this mean that the tutor has formed his or her opinion of us during the first two weeks?

Many students would change their behavior during tutorials if they weren't evaluated by the tutor. It would take some of the stress off of a number of students and they wouldn't feel so driven to impress the tutor. Still, others state frankly that they would be less motivated and that their participation in discussions would tail off.

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In summary, the many forms of bias in this evaluation are evident. Nevertheless, we think that evaluation by the tutor should be kept its incentive value for many students. Most students feel, however, that it should only represent 5% to 10% of the final unit grade. Tutors should also take into account the formative evaluation from preceding units because it would be of greater benefit in terms of training.

### *Examinations*

Examinations are part of any evaluation process and it doesn't look like we can find any way around them. Generally, we find them difficult enough. They also appear fairly representative of the material covered during the phase. Furthermore, we are fairly well prepared for them.

The current system of evaluation consists of a series of examinations that students must take at the end of each term. They deal with the material covered in each unit during the term. Many students would rather have the examinations held at the end of each unit. There are, of course, arguments in favor of both positions. On the one hand, the current system means that we don't have to worry about exams for three months. In addition, students should be able to better integrate the information because the material seen in the other units should facilitate understanding that in another. To illustrate, some feel that would be easier to pass the respiratory-system examination after taking the cardiology unit. In contrast, others feel that you have to really perform during examination week because it's the only period for written evaluation. If the examinations were at the end of each unit, the material would be fresher in our minds. On the other hand, examinations would occur more frequently and many don't like the idea of repeated stress. The debate is far from being over and student opinion seems evenly divided over the issue.

Since the philosophy of the new program is based on comprehension rather than on memorization, it would be beneficial if we could understand the errors that we made on the summative examinations. That way, we could avoid repeating them! That's what is done in the second-year gastroenterology unit: the correctors decided to provide explanations for the questions on which we performed less well. We enjoyed that: isn't getting feedback on errors a good way to learn? We hope that this experience will be repeated in the other units.

## Other Means

### *Learning from problems*

It's interesting to note that a large proportion of students prefer PBL to lectures. Problem-based learning has become their preferred learning method. It should be evident that you learn better with a method that you like. Having said that, we have observed that many of us would like greater synergy between PBL and lectures. In fact, mini-conferences may be more suitable for some topics.

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### *Lectures*

Lectures have their place, even if PBL must clearly dominate. The current frequency of lectures appears to be adequate. Lectures would be more useful if they were better prepared. Many students feel that these more or less well-structured lessons contribute little that is new. They should be rethought to be more congruent with PBL: they shouldn't take too much from traditional methods. In fact, students seem to prefer «sessions» to «lectures.» Sessions take the form of summaries, updating knowledge, clinical cases, and introductions.

Many students like the model for integration sessions in the endocrinology unit. The presentation of clinical cases is followed up with a series of questions related to studying the cases. Couldn't some of the lectures be adapted to this model?

Furthermore, students would really like to have basic courses in anatomy. This is a major gap in our training. Our knowledge of anatomy is limited because the program doesn't emphasize it and because the topic doesn't lend itself to PBL. Many students also feel that the teaching of pharmacology has a number of shortcomings that need to be addressed.

### *The problems*

Problems are the lifeblood of PBL! In fact, they are the cornerstone of the new teaching system. Building the problems, therefore, is of crucial importance. A well-formulated problem should allow us to put forward several hypotheses and should guide us towards the relevant learning objectives. The majority of problems meet these criteria and lead us towards the concepts that we need to master.

Since humanism is one of the basis of the new program, we find it deplorable that few problems refer to it directly. There are very few discussions about it throughout the tutorials. Obviously, we can't spend half a tutorial talking about humanism. We could, however, discuss it for at least a few minutes. Since the program attempts to inculcate the notion of comprehensive patient management rather than focusing on the disease, at least some of problems should specifically reflect this.

Fortunately, the clinical skills unit compensates for the lack of attention given to humanism in the problems. In fact, the COMMUNICATION AND HUMANISM component helps us discover this facet of medicine and allows us to discuss it. These discussions make us aware of the difficulties that a person can have when faced with disease or a handicap. We also learn to better recognize the resources that we have for establishing a helping relationship with the patient and for better assessing our individual limitations.

### *References*

Ah, the thorny question of references! Why thorny? Because students are very divided over this question. Here's the dilemma: should the tutor tell students which references to consult

in order to understand and analyze the problem? It's a simple question...with a rather complex answer.

Many students would like the tutor to indicate which pages should be read in whatever reference. The end of step 5 (formulating learning objectives) would be a good time for it. This would be very reassuring; the students would be heading in the right direction even if the objectives weren't really clear. We would lose less time in discovering which volume to consult. Lastly, we would be sure that we had covered the «right» material.

Other students would rather find out about the references when we come back into the group meeting, that is, after step 7 (summarize the information collected and verify it by applying it to the problem). This would be done solely to ensure that the right material gets covered. This way of proceeding would also take care of certain shortcomings.

Not a few students have spoken out against these suggestions. They feel that these approaches would severely inhibit autonomy, initiative, and, as a result, student motivation. It goes against the goals of the new program. We would tend to read everything that the tutors mention and there simply wouldn't be enough time. If the learning objectives are clear and precise, then we will be able to find good references on our own. The diversity of references consulted by the students is one of the reasons that coming back into the small-group meeting for step 7 is so valuable.

In reality, only a few tutors provide a list of references. Most of the others let us find our own. Most of the references that we use are ones that we have purchased and which are expensive, especially in first year. Furthermore, we spend a lot of time with the photocopiers. Since the various opinions on the topic remain firmly ensconced, the debate is likely to wage on for some time to come.

## The Rotations

### *The clinical immersion rotation*

The clinical immersion rotation occurs at the end of the first term in the first year. Some believe that it comes a little too early in our training. Nothing could be further from the truth! The purpose of this three-week rotation isn't to inculcate new knowledge but rather to immerse us in the "daily practice of an ordinary physician". The fact that we have very little knowledge is actually an advantage because it allows us to see more readily the practical and human side of medicine.

This is a very enriching rotation. For many, it confirms their choice of career. The rotation elicits a great deal of motivation by bridging the gap between the somewhat «hard-to-digest» theory encountered in the first term and medical practice, which we will find out

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about later. The rotation provides us with the opportunity to see how physicians really live and to discuss with them how they manage to balance their professional and private lives. Furthermore, it ADH a humanistic touch to our view of medicine.

The clinical immersion rotation is greatly liked. It helps us to get over the obstacles in first year.

### *Community problem-based learning rotation*

The community problem-based learning rotation occurs at the end of the second term in the second year, in March and April. Each day, we take a history and perform the physical examination on a patient with a view to attempting to account for his or her problems. This process is carried out in groups of three to five students in a hospital.

Students really appreciate this rotation. It allows us to put into practice notions that we have been learning since the beginning of the clinical skills unit. Analysis of the patient's problems provides continuity with the use of problems in PBL. Since there are no new theoretical notions to learn, we can relax a little between the second and third terms in a really busy second year!

All in all, the rotation is enriching. It's really well scheduled on the program calendar, as is the immersion rotation. The community rotation adheres to the philosophy of the new program: autonomy, working in small groups, problem-based learning, self-directed learning, and humanism.

## Clinical Skills

We derive a great deal from the clinical skills unit. This part of the program starts in the second term of the first year, in January, and ends with Unit 14 at the midpoint of the third year. It's a long continuum that ADH the practical part of medicine to the theory learned during tutorials.

We consider the clinical skills unit, first and foremost, as a tool preparing us for future practice. It brings the theory that we have learned to life by creating an association between knowledge and its application, thereby enhancing our motivation. We are privileged to be able to discuss communication and humanism in our medical course. This will be a practical tool equal to the theoretical knowledge. How lucky we are to be able to apply our new knowledge to real patients starting in our first year of medical school!

There are, however, a few shortcomings. In fact, certain monitors seem ill-prepared for the task since they don't adhere to the method described in the reference book. This results in variations in learning from one group to the next. It's also deplorable that we don't have enough opportunities to practice and that are techniques are not adequately corrected.

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We feel that the program is very full and the clinical skills unit is no exception. It is sometimes hard to keep up when, in less than two days, we have to study for tutorials, read for the clinical skills session, and write up a case history!

Nevertheless, these are minor defects; the clinical skills unit is very enriching and stimulating.

## Student Life

What strikes us most in our Faculty is the mutual help and cooperation between students. There is also comradeship. The new method, with its small-group meetings and discussions, surely has something to do with it. That being said, some students feel that the tutorials encourage competitiveness; everyone vies for the best grade from the tutor and forgets about functioning as a group.

Half the students in the Faculty feel that enough time is devoted to extracurricular activities (sports, cultural activities, and so on), while the other half does not. Paradoxically, the schedule for the new program gives rise to both satisfaction and dissatisfaction. The amount of free time in the schedule enables us to plan study time and leisure time, so that no has to give up their favorite activities. On the other hand, there is so much material to be covered, that you could study all the time if you wanted. Students who study compulsively or who lack self-assurance neglect using their free time. Despite the fact that the program is very demanding, most students have little trouble managing their time.

Since the University Hospital and the Faculty of Medicine are located outside of Sherbrooke relatively far from the main campus of the university, time can drag on. Many students don not like this isolation because we don't live with other medical students. Social contact with students from other faculties is very limited.

In summary, although a number of students dislike the Faculty's geographic isolation, most are pleased with the overall atmosphere.

## Conclusion

Since we are right at the heart of the new program, we feel that we are well-placed for evaluating it. That is why the Faculty listens to us, even if we don't always think that change occurs fast enough.

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We get a lot out of the new program, including:

- autonomy;
- self-confidence;
- critical thinking;
- curiosity;
- close contact with teachers;
- synthetic reasoning;
- cooperation with peers;
- reasoning and comprehension;
- individual responsibility for our study time;
- comprehensive approach to problems;
- humanism; and
- work in small groups.

The program could be improved through some small changes:

- better-prepared lectures (more summaries) so that they are better integrated into PBL;
- more integration sessions;
- better references for certain units;
- improvements in the teaching of anatomy;
- a change in how tutors evaluate students, even if the majority of students support the need for such evaluation;
- a more unified approach by clinical-skills monitors;
- sounder feedback from monitors on the physical examination in the clinical skills unit;
- feedback on the main errors in summative examinations.

Problem-based learning makes many of us feel insecure because of its novelty and the autonomy it gives us. Students wonder if they are studying the right material and if they are learning the same things as others. Students have to adapt both to PBL as a method and the insecurity that it engenders. Nevertheless, the method is stimulating since it teaches students how to work by and for themselves, individually and in groups, and to cooperate.

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## Continuing Problems in a New Socioeducational Culture

Jean-Pierre Bernier and Jacques E. Des Marchais

*Blinded by the absolute, he believes that  
incident isolated in time and space  
is a permanent state. He doesn't understand  
that what has occurred can never be exactly  
reproduced because the context is never the same  
- Paraphrase of Stuart Chase*

March 1993. Two of the architects of the teaching reform, Bertrand Dumais and André Plante, and the two authors of this chapter meet to think about the future of the reform undertaken in 1987. We have achieved successes; we have conducted analyses; but when all is said and done, we are still left with questions, unsatisfied expectations, and persistent worries. Both our own experiences and recent advances in educational sciences have led us, as teaching physicians, to a new perception of the art of structuring medical education. What we want now is to evaluate our teaching experience using a more comprehensive approach.

### A New Socioeducational Culture

The observations reported so far could be called ethnographic: they relate to two major dimensions of change in an educational culture, everyday activities and the educational conditions in which the job of student and teacher will be carried out from now on. Let us take a closer look at these.

#### *New activities for students*

From their first week in the Faculty of Medicine, incoming students are introduced to a new cycle in student life comprising small-group work, independent study, and the occasional lecture. Small-group work accounts for most of the structured activities in the students' calendar. Student life is to a large extent influenced by movement from place to place and assignment to small groups. These groups reconstituted randomly periodically during the year. Since students have no say in the selection, they must constantly adjust to new group members. On the other hand, it provides opportunities for enrichment. Presence in the Faculty of Medicine thus becomes intermittent and fluid, in contrast to the monolithic approach of traditional programs dominated by lectures delivered to entire classes according to timetables that covered a whole week.

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*Diversity in roles, locations and modes of learning*

With PBL and CRL sessions, students no longer have a single role; from one session to another, it varies between group leader, scribe at the blackboard, CRL data holder, and so on. These varying responsibilities, all of them needed for the work group to be effective, foster the acquisition of diverse intellectual and social competencies. To meet their personal learning needs, students seek out a larger number of publications. They visit the library more often; they photocopy more documents. Because of the importance of the periods of self-directed learning, they spend less time at the Faculty, especially those who come from outside the Sherbrooke area. Some feel that this phenomenon erodes a sense of Faculty belonging. The consequent freedom, however, allows for a more varied university life, for example, through regular involvement in athletic or artistic activities. At the same time the system also requires greater autonomy in time management, which results in a degree of insecurity and indeed loneliness.

*Interpersonal relations*

A student will establish differing interpersonal ties with peers, senior students in the program, professors, and Faculty administration. The mutual dependency felt within small learning groups means that peers become associates much sooner. This new dynamic elicits an approach based on self-help and cooperation in shared responsibilities, but it also elicits competition. In this fashion, the student setting foreshadows professional life. In an educational system where students have a larger say in the choice of their modes of learning, turning to senior students is an attractive and indeed necessary way of obtaining information and a valuable form of mentoring. However, this form of networking between successive classes can have an undesirable effect if it vitiates the educational value of a PBL problem or an assessment activity whose effectiveness derives in part from the newness and realism of the situation they present.

In the Faculty of Medicine, students encounter professors as members of small learning groups. It is true that teachers are undeniably invested with knowledge, clinical and research experience, and moral authority. These traits, however, are encountered through close relations in which the teacher is a senior partner in the educational enterprise rather than a dogmatic "prima donna". Teachers become facilitators rather than dispensers of medical science; their actions relate to process as much as to content. The level of their knowledge of disciplinary content varies; sometimes students are called upon to be understanding. This closeness gives students a taste of conditions that will prevail within teams of practitioners and fosters transmission of the clinician's or researcher's specific experience. And that is how the student will see the role of teacher.

Is it possible that, in consigning student observation to tutors, mentors, and clinical-skills facilitators, we have created a "role conflict", that of evaluator versus educator? The evaluator's responsibilities coexist harmoniously with those of the educator to the extent that assessment is playing its full formative role and the teacher grasps that the act of assessment is central to education.

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*A new role in the process of learning*

Our program involves students much more in teaching evaluation. They also contribute to the training of teachers in medical education.

Student evaluation of program components bears as much on learning activities as on the instruments with which the results are assessed. Meetings of stewards and small PBL groups with unit heads; questionnaires; and unit reports: all these constitute instruments of ongoing change. Student involvement is sought in the annual evaluation meetings. At meetings of the Assessment Committee, students have an opportunity to evaluate their summative examinations. They are also invited to judge the taxonomic level of problem-analysis questions. Their involvement in this research on teaching methods helps them better understand the medical curriculum.

Groups of students are invited to hold some of their tutorial meetings in front of a two-way mirror for the benefit of teachers in training or visitors from other universities. These activities are followed by feedback sessions and informal discussion in which students find they are given credit for a degree of empirical competency in PBL practice. These discussions are also useful to them in their own studies, because they deepen the knowledge of both theory and practice of the PBL process.

In a word, the teaching reform has led to a considerable increase in the number and diversity of student activities by making qualitative changes to the process of acquiring the content to be learned. These changes result in students being better able to fill the new or different roles that society wishes physicians to assume from now on.

## New Activities for Professors

*The scientific versus the educational paradigm*

From the start of the reform, and especially during Dr. Michel Bureau's deanship, the Faculty of Medicine recruited numerous new professors. Although PBL has become an integral part of the culture of the Faculty, it is still the case that professors of medicine are most often chosen for their disciplinary competency or because their profile in cutting-edge basic research is promising. Clinicians are attracted to this type of medical faculty/hospital complex by the potential for practicing tertiary, highly specialized, high-tech medicine. Basic researchers see an opportunity to conduct competitively funded research with their peers; the topics of their research are usually far removed from basic clinical phenomena. Such factors, which have a structural impact on professional careers, lead our professors to make medical practice and post-graduate teaching as much of a priority as the development and execution of research projects and the training of master's and doctoral students. In short, this professional context tends to make professors primarily discipline-focused in their orientations and concerns.

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In the training workshops on medical education that preceded and were concurrent with implementation of the new program, professors had to become aware of two educational approaches: one tied to the discipline of medicine and another relating to the educational process itself. They were thus called upon to reflect together on a more generalized, that is, a less differentiated definition of their role as professors. In so doing, they were obliged to address the question of passing from a reductionist training to a humanistic training. Moreover, they were prompted to focus their efforts on process more than on content taught. The reference point for competency was shifted from those who stood at the heights of scientific disciplines to educational specialists. This shift resulted in conflicts of authority and allegiance. Added to this instinctive response was the fear that scientific rigor, which had constituted the foundations of medical education since Flexner, would yield to vague issues inspired by the "soft" disciplines of the social sciences and humanities.

### *Adopting PBL*

Subsequently, the building of PBL units led the faculty to confront the need to delimit the subject-matter content and give up objectives that were formerly considered essential in the teaching of their disciplines. This process of selective refinement took place under the critical, vigilant eye of specialists concerned with relevance and validation.

The laborious process of integrating professors from the various basic sciences (biochemistry, pathology, biophysics, and immunology) into the medical-biology unit of Phase I took at least four years. In tutorials, professors constantly had to resist the temptation to give mini-lectures, especially when students' prior knowledge was such that they ran out of explanatory hypotheses. Tutors were obliged to favor the use of «why?» instead of "here is why". Several professors who became tutors or mentors in units whose content they were less familiar with discovered promising perspectives for continuing education. Others who were more hesitant to stray far from their specialties felt somewhat marginalized. The availability required of professors during PBL units entailed changes in the organization of hospital care (for example, in the OR) and in management of research laboratories.

### *Contribution to examinations*

The field of student assessment underwent expansion under the new program as methods of implementation were diversified. Recourse to a new kind of written examination, problem-analysis questions (PAQs), created needs for training of professors that were not wholly satisfied by the few workshops given at the start of implementation.

The necessity for adequately supplying banks of questions for different units, so as to provide for formative and summative examinations, creates a cyclical pattern of pressure. Most professors are less attuned to the requirements of assessment than those of teaching properly so called, since the role of tutor is an individual responsibility, while that of

assessment is collective and viewed as being more institutional. The introduction of open short-answer questions (OSAQs) and problem-analysis questions (PAQs) has entailed the presence of a larger number of professors, among other things at the correcting bee for the written summative assessment. The objectively structured clinical examinations (OSCEs) on clinical skills mobilize about twelve to fifteen professors for at least three hours, four times a year, during preclinical training and subsequently for each major discipline in the clerkship. We constantly run into difficulty recruiting correctors in sufficient numbers. And yet, the teaching staff as a whole recognizes that these methods of assessment are appropriate to verifying whether objectives of this kind have been achieved. These recruitment problems have led management to compensate assessment activities, considered essential, with teaching activity units (TAUs).

#### *Assessing students during tutorials*

Tutors and mentors find it difficult to assess students during small-group work sessions. Part of the problem derives from what is being assessed. Tutors and mentors are not required to directly verify acquisition and memorization of knowledge. Their assessment bears on factors that are new to them: analytical ability, communication, interpersonal relations, cooperation, humanism - in short, new areas with measuring instruments that seem subjective. Through their actions, tutors encourage students to cover the contents and to apply them, while motivating them to learn in a self-directed manner. In addition, teachers are required to selectively observe each of the eight students over a relatively short period, in order to give each one descriptive feedback midway through the unit. Teachers are also called upon to assess student performances at the end of units as rigorously as possible. Given the short time available to formulate these judgements (an average of four weeks), and given the problem posed by quieter students and the difficulties of transforming subjective and holistic perceptions into detailed judgements, this assessment activity continues to cause criticism and recrimination to rain down on the heads of those in charge of the program.

In short, the new student-centered program has brought about profound changes in teaching activities. While difficult, these changes have been effectively supported with appropriate, dynamic training programs, inspiring leadership by faculty, an equitable system of remuneration, and a system of promotion that takes "teaching acts" into account. Most professors have taken ownership of the theoretical foundations, goals, and methods of the reform with dedication and conviction, despite persistent reservations. With all these accomplishments behind us, the challenge posed by undergraduate study is now a renewal that will prevent getting bogged down in fresh "diseases of the curriculum".

## Pedagogical Conditions for the Reform

### *The student point of view*

A tutorial has just begun. The PBL group's steward has gone to the secretary's office to get the text for the problem. The members of the group then read the problem in an undertone. Pen in hand, they circle or underline words whose meaning is obscure, clinical signs and symptoms, the problem's priority cues, and laboratory-test results and treatments administered to the "paper patients". In first and second year, the exercise will deal with the analysis of phenomena. Clinical cases have such value as prototypes that students' prior knowledge often enables them to formulate an early diagnosis even before they are able to explain the more or less familiar individual clinical phenomena that confront them.

Next, formulation of hypotheses about the phenomena to be explained is begun. Some students already know the explanation. Their prior experiences have prepared them, because the problem resembles a situation they have encountered. The whole process truly consists of a task of construction, of the development of new knowledge based on prior knowledge, the ultimate goal and justification of a PBL approach. The structure of the preclinical phase, organized into units that are defined by system, tends to promote explanations based on a problem's context as much as on its content.

Participants' attention is focused on the blackboard, which becomes the communal memory of the group's work. The problem's various elements pile up on it: hypotheses, some retained, some rejected; diagrams, some of them chronological (linking the causes of biomedical phenomena), some of them anatomical (reworked according to the particular pathology). Some things are erased; agreement is reached about what is kept. What remains of this process of collective work on the text is carefully reproduced so that every member can preserve a record of it: this constitutes the work of the scribe, whose one-page summary/synthesis will be handed to his or her peers as soon as the tutorial is over.

In step 5, students, viewing tutors as subject-matter experts, place full confidence in them. Sometimes tutors announce that students will have to study a certain number of concepts that weren't discussed during the tutorial. "At last", think they, "the problem's hidden agenda"! Apart from this, the list of objectives formulated by students corresponds to that of the *Tutor Guide*. In any case, it is known that such-and-such a problem in neurology, for example, can be found in Chapter 8 of the main reference work that has been recommended, because the indications provided by the problem discussed in the unit pointed that way. And because you've become familiar with the way this reference work is organized. And, too, because second-year students say so. But in step 9, where assessing group processes and dynamics is on the agenda, the group's natural tendency is to skirt delicate matters that might lead to singling out certain "dysfunctional" individuals. There is a preference for steering discussion towards neutral territory, the quality of the problem and of the recommended references.

The program requires that midway through a unit, tutors conduct a formative assessment of students. Students always assess themselves first, usually too harshly or too leniently, but in any case, in a somewhat general fashion. Before hearing the tutor's comments, the typical student insists on informing the tutor of the features of his or her own personal style and reassuring the tutor of his or her progress ("everything is fine"). The student seizes the opportunity to make observations about group functioning - which he or she had considered wiser not to broach during the discussions designed for this very purpose in step 9 of the tutorial!

The reference works recommended by those in charge of the unit were not written with problem-based learning in mind. Tutorial objectives are scattered in many different chapters. Sometimes the content is really at the master's level (for instance in biochemistry); sometimes readings bog down in discussion of diseases, which the program defers until the clerkship. Students become anxious. The thing to do is ask the unit heads, at the next stewards' meeting, whether all this has to be learned for the exam. The ideal approach, as we're told again and again, would be one problem, one chapter, one reference work. For this problem, you should use Guyton for physiology, Robbins for pathology, Harrison for the clinical side: that's individualized learning at its best! Problems in the third-year unit on multidisciplinary problems (Unit 14) are long and complex: patients have three diseases affecting five systems; you really have to "integrate" the whole thing; luckily there is one week to do it in!

Students do find that the problems in Unit 14 genuinely provide good preparation for clerkship rotations in a university hospital. Students feel awkward the first time students see patients on the ward during the clinical-skills sessions. Since being admitted, the patients have been seen by the resident, the clerk, the program director, and a number of similar individuals working with the various consultants. The patients are very tired. They have charts that are "as thick as a brick"! - three volumes - and eight prior hospitalizations. But in other clerkship rotations, such as family medicine and orthopedics, the patients are less like those of Unit 14.

During the clerkship, students find that clinical-reasoning learning is "less stressful". CRL exists exclusively to learn how to reason; operating-room instruments are nowhere in sight! There's no need to question patients or their families, help them undress, examine them, or write up four-page case histories. With real patients, the reason for consultation and the history of the disease are not always clear; in CRL sessions, they are provided. A hypothesis has even already been formulated; there are specifications as to what further information to request and why it's needed, and the student data holder supplies it. No need to prescribe laboratory tests using ARIANE (Sherbrooke's university hospital's medical-administration computer system) and wait for results. The only thing you need to do - and you have got to do it - is reason! Not only that, but CRL allows you to achieve some of the clerkship's required objectives for which real-life patients are not always available in the hospital during the rotation.

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All these are observations that students have made to us, year after year, especially during social evenings.

*The point of view of professors and those in charge of the program*

Under the old curriculum, in general, for any given professor, teaching consisted of giving three or four three-hour sessions of lectures on one's favorite subjects within one's specialty. In the first year, the job entailed preparing slides, transparencies, and handouts, and three or four multiple-choice questions for every hour of teaching. All that was necessary afterwards was to work in changes in detail every couple of years in order to reflect scientific advances.

With the new curriculum, students are placed at the center of the learning cycle and the methods used. Confronted with the need to design their plans in this new way, professors soon discovered that they must first meet students' needs and that they must do so not just by respecting certain models but by understanding what the student feels. We placed great emphasis on the need for congruence between learning objectives, teaching method, and the instruments of student assessment.

In recent years, the Faculty of Medicine has broached a change of educational paradigm. Cognitive psychology is now seen as the science that underlies teaching activities. It was necessary to grasp the distinction between cognition (the fact of understanding a subject) and metacognition (the analysis of "how you knowingly come to understand the subject"). Under this new paradigm, new knowledge develops through diagramming and the production of rich and complex semantic networks, using prior knowledge as a point of departure. For this process of acquisition to be effective and knowledge acquired to be accessible in clinical situations down the road, it was necessary to develop specific encoding in memory for it. This was done by building situations that prefigure given medical activities and make use of prototypical clinical syndromes chosen for their suitability for use in supporting analysis. This change in the reference point of teaching had a concomitant effect of forcing awareness of the nature of the reform.

These new models prevailed as problems were devised for the PBL units. It was necessary first to construct, working with the reference manual or old course plans from lecture-style courses, a discipline's concept tree for each unit. Each unit must comprise a limited number (six to twelve) of problems. It was therefore necessary to make sometimes painful choices. We had to take account above all of the epidemiological significance of diseases for the population of Quebec and the value of certain prototype syndromes essential to the learning of the underlying sciences. We also had to see to it that problems were realistically written up, in order to give rise to interesting discussions. Above all, the problems must motivate students to learn as much as possible and to learn in depth. When problems were being built, the most difficult task consisted of translating learning objectives into clinical phenomena. We could not simply say, "The professor will ask students to read up on the anatomy of the cerebellum or various kinds of amino acids".

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Then professors began filling their new role as tutors. To forestall any possible tendencies to give mini-lectures, we began by favoring a passive tutor style characterized above all by an understanding of active listening. The tutor could only intervene as a last resort, when students had lost their way in their more-or-less structured brainstorming process. Inevitably, many objectives never attained formulation. Accordingly, we discussed the appropriateness of supplying students with the objectives, at the risk of compromising the PBL method's effectiveness. We also encouraged tutors to become more active and ensure content coverage by asking questions.

How were tutors to assess a student's capacity to analyze problems, communicate effectively, display humanistic behaviors, and make autonomous progress in learning? Every group has one or two students who do not speak much. It should be possible to pay more attention to the student who has trouble learning, but the tutor is kept busy by the more proficient students. Tutors are also called upon to provide descriptive feedback during formative assessments; students having trouble often perform weakly during tutorials and display little critical sense when they are asked for self-assessments. It is sometimes possible to base suggestions that students modify their learning strategies on some of their contributions in tutorials; for instance, by studying in depth rather than superficially, so that the knowledge they store in their memories is laid out logically rather than just stacked up.

#### *Cognitive levels addressed in assessments*

In looking for guidance in constructing written examinations, professors went back to the hierarchy of cognitive faculties as presented by such great teachers as Bloom and McGuire (Bloom et al., 1956; McGuire, 1990). These somewhat abstract systems of classification, seemingly crystal clear when presented as theory, proved complex and ambiguous in application. Our view was that it was possible to assess the processes of memorization, understanding, and analysis, respectively, using a range of instruments considered to be congruous with the relevant mental faculties: multiple-choice questions (MCQs) for memorizing isolated facts; open short-answer questions (OSAQs) for the understanding of phenomena; and the new problem-analysis questions (PAQs) for analysis and clinical reasoning. Memorization of isolated facts, that is, use of the memory alone, was relegated to the lowest level in the taxonomy of student mental faculties. Memory and memorization were thus discredited, while analytical and clinical-reasoning ability were raised to the summit in the hierarchy of mental functions, and granted almost unlimited respect.

The taxonomic approach is highly regarded in our Faculty of Medicine. Nevertheless, the average professor cannot be said to have yet grasped the benefits for everyday use of these learned methods of classification. It must be acknowledged, though, that the taxonomic approach elicits significant interest when it comes to the incremental strategic planning of learning methods over the course of the MD program. The benefits yielded by the approach can help students work out the "spiral" of their knowledge acquisition and developing clinical competency.

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The problem-analysis questions (PAQs) were devised in a research and development context. Test-measurement studies determined that the construct had a degree of validity. Cognitive psychology is in its infancy; it remains risky to transfer the claims it makes to the design of educational activities, for it still seems to be dogged by contradiction. Thus it is claimed that there exists a general analytical faculty independent of the ability to memorize isolated facts and link them together in schemata; yet it is also claimed that certain specific contents are more apt to trigger an individual's reasoning ability if that person has built up a rich knowledge base on a particular subject in his or her memory. Cognitive psychology has restored legitimacy to memorization by explaining the significance of long-term memory; in order to reason, it is necessary to acquire specific knowledge. Thus, in medical diagnosis, the expert is distinguished from the novice by her or his highly efficient reasoning process. In the view of most experienced clinicians, this capability depends on a particular mechanism known as pattern recognition. Through this process, an expert can tie in the clinical data obtained from the patient and the physical signs observed during examination with her or his rich theoretical and clinical experience.

*New frontiers in the teaching and assessment of clinical skills and attitudes*

Since the curriculum underwent reform, certain concepts and instruments have gained greater importance in the sphere of clinical skills. Changes have related to the teaching of both psychomotor and affective skills. In practice, these two types of skills are closely interdependent. This is especially true of patient-physician communication, which was given special attention in the development of the new curriculum. Professors became acquainted with teaching techniques few of them were familiar with: role-playing, keeping a dairy, standard patient, and so on. The standard-patient program was designed to teach the principles of interviewing patients with difficult personalities or behaviors. As for teaching the taking of the case history and the conduct of the physical examination, emphasis is increasingly being placed on the need for the facilitator to conduct direct observation, using instruments specific to the purpose, of students in the presence of real or simulated patients. Observation is followed by immediate formative feedback.

The teaching of medical humanism has met with the greatest lack of understanding and continues to elicit resistance from both students and professors. This same resistance is encountered in the teaching of interdisciplinarity. No one disputes the relevance of relational concerns, which are integral to present-day practice; but what is difficult is defining the distinct content of medical humanism. Nor is there agreement on the importance of dedicating specific teaching activities to it, since some would prefer to pay more attention to the acquisition of new knowledge in oncology, clinical pharmacology, molecular genetics, and anatomic dissection, for example. Numerous professors believe that the example they themselves afford, if used judiciously, is sufficient in the transmission of this important component of medical education.

In a word, from the outset of the new curriculum's implementation, we have made an effort to translate into research and development theoretical models that are attractive, complex, and constantly evolving, and that affect both the planning of student learning and the training of faculty. The reflections and developments associated with this process (for example, those linked to the PAQs), as well as professors' and students' new roles, have permeated student academic life and have equipped them with new concepts and instruments from modern medical education. These changes, along with recent contributions from cognitive psychology, have drawn student enthusiasm, perplexity, and above all, creative energy.

One needs to have been a professor in the Faculty of Medicine at the start of the 1980s as well as in 1994 to have a sense of the incredible difference between those two periods. We left behind a so-called traditional curriculum for an entirely new paradigm, a socioeducational system that retained no more than three traditional components: multiple-choice examinations, the imperative of learning medical science, and the presence of the patient with her or his clinical problems. So many components of today's curriculum are new—even the constant concern for community needs that is now as much a part of our social as of our pedagogical climate. How simple our lives as professors were in the early 1980s, when all we were called upon to do was provide a few hours of classroom teaching on our own mini-specialties and do rounds with clerks. And here we are now, constantly called upon by successive generations of students with whom our roles change from one year to the next, from PBL tutor to CRL facilitator to clinical-skills instructors.

## Persisting Problems

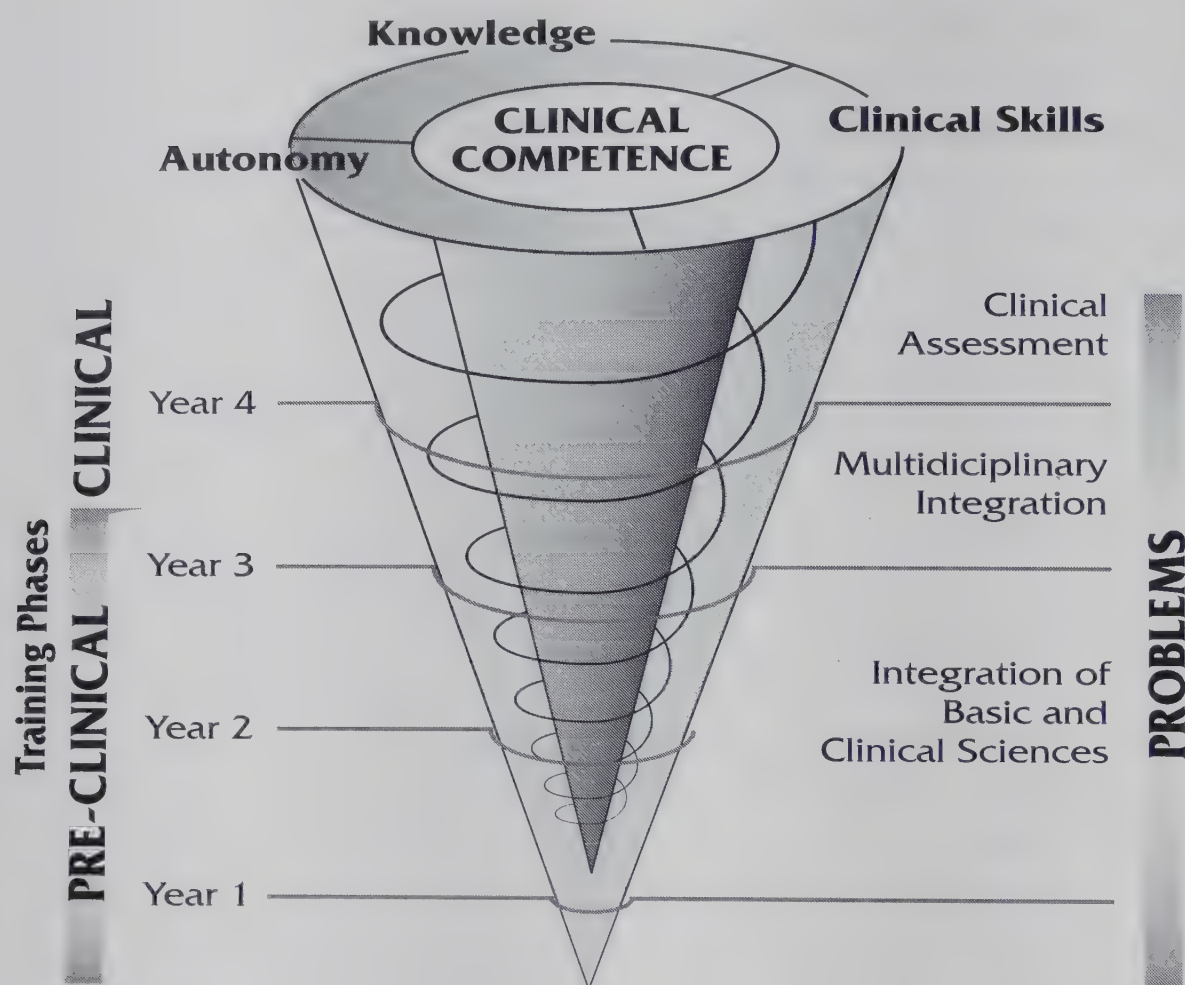
### *Incremental learning on a spiral model*

The metaphor of the spiral helps to grasp our new educational system. The image of the spiral evokes the notion of gains made over time in concentric circles and loops around a longitudinal axis, broadening as they rise from the base to the summit (Figure 1) (Tardif, 1992).

### *Acquiring the grammar of medical sciences*

In Phases I and II of preclinical training, this approach takes the form of a focus on understanding clinical phenomena and the principles of their treatment. Pathological physiology thus constitutes the key medium for the integration of both clinical and basic sciences. This approach entails a degree of fragmentation of contents, with knowledge being organized on the basis of organs/systems.

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Sherbrooke 1995

Figure 1. MD program

When it comes to the teaching of clinical skills, a parallel and complementary process consists of furthering the mastery of the rudiments of case-history taking and conducting a physical examination, once again parceled out by systems and apparatuses.

In Phase III, which takes place during the first term of third year, the circles broaden to take in knowledge of the clinical procedures that determine treatment of pathologies. During this multidisciplinary unit, which is spread over the whole term, emphasis is placed on the pathological physiology of complex syndromes. These syndromes affect several systems of the patient's body and many aspects of the patient's humanity; they change as they evolve. During the learning of clinical skills, the gathering of case-history data and the full physical examination constitute a parallel process through which the student acquires competencies within a unified structure. Knowledge is enriched through differential diagnosis and planning of the course of action to be taken to solve complex problems. In Phase III the knowledge spiral allows the student to make not just a quantitative, but a qualitative leap in the process of acquiring the competencies needed in medical practice.

*Situational and experiential knowledge gains during the clerkship*

The spiral broadens during the clerkship. The student is integrated into the structure of clinical services and starts to take on the dual role of learner and practitioner, under the supervision of clinicians. The range of knowledge potentially necessary to the solution of clinical problems is wide open; it depends on clinical presentation, which can be of greater or lesser complexity and is often unspecified. Learning must thus focus on the patient's needs at the moment, and on the context in which they are expressed. The student must therefore become much more proactive than during preclinical training. Knowledge broadens during this phase and requires comprehensive integration in order to set all the stages of clinical reasoning in motion, from the reason for consultation right up to effective treatment of the patient. Once the knowledge-acquisition spiral reaches this stage of development, it will remain as a permanent and dynamic process, theoretically infinitely open: it should persist throughout postgraduate education and subsequently throughout the physician's career. In order to be properly mastered, therefore, the content must be pruned and apportioned at the most propitious times.

*The teaching-strategy spiral: Adapting problems to the students' level*

In order to help students through the learning process, it was necessary to devise efficient and consistent contexts and mediums for the whole trajectory of ascending loops in the competency spiral. Problem-based learning played an essential role, but not without undergoing transformations and changes in application. What were the consequences of our pedagogical choices, in particular those affecting the balance that needs to be established between the interventionism appropriate to teaching-activity infrastructure and training designed to make students autonomous?

*Compromise and paradox: A cognitivist paradigm within a behaviorist structure*

Students in Sherbrooke's Faculty of Medicine, who are younger than their peers in other Quebec medical schools, begin the preclinical phase of their studies at around age 19, fully three years younger than students in medical faculties in English Canada. They emerge from a relatively rigid educational system that generally leaves little room for discovery. Their prior knowledge of biomedical subject matter is genuine but very basic. Their competency in analyzing biomedical phenomena or solving problems is of necessity rudimentary.

We decided to initiate them to problem-based learning using a strict ten-stage method (See Chapter 3). In this particular application, cooperative teaching defines a student's role quite precisely. Its design is inspired by the process of scientific analysis of natural phenomena. It seemed to us appropriate to the students' acquisition of the hard kernel of knowledge that forms the base of our spiral. The written problems presented to students during an initial type of PBL are short, well-defined, and fully presented during a single study period; they are designed to illustrate isolated, representative phenomena that are clearly differentiated within an organ/systems matrix. In the practice of medicine, a

competent professional builds up a problem autonomously, using clinical and paraclinical data revealed by the patient. His or her task usually consists of determining a therapeutic course of action which is conditioned by the way the problem presents. In a PBL context, a problem is reconstructed abstractly by the teacher, who is almost always an expert, working with realistic situations organized in a concept tree that was laid out when the unit's subject matter was prepared. The problem becomes the symbolic expression of clinical reality. In general, one is dealing with a narrative text, which is therefore shorn of the true conditions of an encounter with a patient.

It is felt that, at the start of training, the system must be interventionist because it aims primarily at training students in analytical procedures and independent management of time for self-directed learning, using a more or less behaviorist approach. Students do not have the choice of attending tutorials or not, or of analyzing problems intuitively. They merely have a degree of autonomy as to the number, occasion, form, and content of the contributions they make in small-group sessions. In independent learning, students do not have the luxury of slowing down if they wish to, because they must master the minimum content determined by the learning objectives for the next tutorial. On the other hand, they do enjoy great autonomy in the organization of their personal time, in their choice of reference sources, and in their individual methods of study.

During Phases I and II, the PBL tutor's main responsibilities relate to managing the analytical process and group dynamics. To be effective, a tutor must be an expert on process, whereas it's sufficient for him or her to be "adequately familiar with the content" to properly manage his or her contributions. In the first tutorial, the tutor helps activate prior knowledge and sees that it is shared. She or he must create a non-threatening environment in which error is tolerated because students are free to contribute their own solutions. All that is required is that the hypotheses formulated be logical and consistent with the group's knowledge base at this stage. In the second tutorial, the tutor is more directive, addressing wrong interpretations in order to proceed to the validation of knowledge.

#### *Mounting the spiral of complexity and autonomy*

The complexity of the clinical problems studied in the multidisciplinary unit in Phase III is more like that in real-life problems. Cases are still presented in written form, but the involvement of the expert-teacher is less apparent. The form taken is closer to a chart summary (on the model of texts used in clinical pathological conferences). The problem is presented sequentially to simulate presentation in a clinical context and trigger the process of clinical reasoning that flows from it. Students are called upon to link up their previously acquired fragmented bits of knowledge in diagrams of hierarchical arcs. This phase constitutes a turning point in the learning process, being at once the conclusion of the preclinical phase and the preparation for the clinical phase; thus supervision is less interventionist and more turf is yielded to the student, who now attends no more than one three-hour tutorial per week. Students identify and delimit their learning objectives; it's up to them to find information in the most appropriate references.

The format of tutorials in the multidisciplinary unit promotes cooperative learning in small groups through the high degree of flexibility of group procedures available for conducting problem analysis. Unlike tutorials in the first two years, there are no required stages, except when one student has to initiate discussion of the problem in order to sketch out its construction and propose a suitable diagram for the physiopathological organization of the case. Table I presents a different teaching format for each level of learning, with specific cognitive tasks assigned to the students, the small group, and the professor.

Problem-solving learning (PSL) small groups meet with their mentors, but only once a week, to conduct a precise assessment of a learning process in whose preliminary stages students carry out wholly autonomously, on their own: analysis of phenomena, physiopathological integration of clinical phenomena, determination of the learning objectives, choice of information sources, whether these sources are human or drawn from the medical literature. As students respond to the degree of autonomy required of them, one witnesses true spiraling growth.

#### *Facilitator*

Train students in clinical-reasoning processes, based on own knowledge and experience of specific content

The PSL mentor sounds out each student and trains students in critical analysis and synthesis building, the linking of kinds of knowledge that lead to discussion of differential diagnoses, and the presentation of a planned therapeutic action. The mentor needs both process expertise and multidisciplinary clinical experience in using the comprehensive approach with the relevant problem.

When students are on clerkship rotation in clinical departments, their learning occurs place through contact with real patients who present randomly in hospital departments and outpatient clinics for general, specialist, and highly specialized care.

Clinical problems encountered in care units and outpatient clinics are by nature open, unstructured, and defined by patients' spontaneous tendencies when students see them. Students have a greater or lesser responsibility for reconstructing a problem according to how far this task has been left incomplete by senior colleagues. The level of cognitive competency required of them thus varies greatly depending on the context of clinical activity. They will derive greater benefits from this stage in their training if they can implement the various stages of the thought process of clinical reasoning in primary care, and under the most direct supervision possible. Thus they will formulate preliminary hypotheses, gather information guided by the process of iterative hypothesis testing, and use the feedback loop regarding their reasoning and their decisions for investigation. This process requires students to apply their knowledge proactively, following an integrated, sequential procedure whose unfolding they alone should manage. Faced with involvement

Table I. Kinds of teaching format suited to different levels of learning with varying student and teacher roles

Level	Teaching For-	Cognitive	COGNITIVE REQUIREMENTS ON STUDENTS				TEACHER ROLE	
			Cognitive content/ Knowledge base	Kinds of Problems	Small-group Tasks	Title	Tasks	
Phases I & II 1st and 2nd year	<b>PBL</b> Problem-based learning	Analyze Explain Declarative Process	Principles-concepts- mechanisms of basis sciences/ clinical problems	Brief prototypes grouped together by apparatus or system	- Structured exploration in stages - Synthesis of knowledge gained - Collaborative-cooperative - Social validation	TUTOR	Intervene in "content" analysis process Facilitate group dynamics and participation Manage PBL method stages and manage time Validate knowledge	
Phase III 3rd year	<b>PSL</b> Problem-solving learning	Integration Establish links Introduction to Problem solving	Complex clinical entities requiring differential diagnosis	Clinical situations that are: long multidisciplinary presented sequentially	- Same as above and establish links to reach a solution - Critical reasoning	MENTOR	Guide critical analysis/solution process Initiate a multidisciplinary discussion of differential diagnoses using a comprehensive approach	
Clinical rotations during clerkship	<b>CRL</b> Clinical- reasoning learning	Introduction to clinical-reasoning approach/ procedural processes	Application of method to frequent discipline-based clinical cases	Frequent, specific, ill defined discipline-based clinical cases	- Investigative strategy - Justify decision (thinking aloud) - Prescribe a course of action based on the diagnosis - Peer reasoning model - Normative process	FACILITATOR	Train students in clinical-reasoning processes, based on own knowledge and experience of specific content	

in medical decisions concerning real-life patients, students must exercise their metacognitive competencies in a rigorous fashion.

There exists a considerable gap between the required objectives set by the curriculum and clinical problems encountered in care units. During the preclinical phase it is possible to ensure some degree of coupling between objectives and learning methods. In the clerkship, the spiraling process of gains in autonomous learning really takes off. There is a criticism to be made, however: as it stands, the program does not sufficiently take into account the temptation to use students for the care team's low-cognitive-level "housekeeping" tasks.

The goal of the clinical-reasoning learning (CRL) sessions is therefore to compensate for the random nature of clerks' clinical activities and enable them both to master the program's required objectives and to practice clinical reasoning and assimilate its stages. Students should themselves construct, prospectively, various components of a clinical case and the data gathering required for therapeutic decisions, not forgetting paraclinical investigation, seeing to it that the rules of clinical reasoning are applied throughout. Retrospectively, they should work from a real-life patient's charts and data available in an already standard information bank. They should be called upon to provide justification if they want access to additional material from this bank. There are significant cognitive benefits derived from this exercise that compensate for the "regression" vis-à-vis the real-life clinical context: the replication of work with patients in the care unit unfolds within a highly faithful simulation, in which a structured procedure constantly subject to justification guides analytical reflection.

As for the CRL facilitator's role, it consists of guiding investigative strategies, questioning, confronting, and stimulating. Facilitators must dip into their own experience and personal strategies with patients. To be effective they must be competent in both process and content. Recruitment of facilitators is thus done among seasoned clinicians from the relevant discipline.

It is our belief that this spiral-based educational system fosters the integrated and cumulative acquisition of knowledge of various kinds. During the process, the problems used are increasingly realistic, in line with the different adaptations of PBL and the clinical material. Learning activities feature progressive loosening of the methodological rules students are required to follow. Students increasingly steer and manage their own learning. The program points out areas of interest, but students are their own guides in discovery. The greater the progress, the greater the responsibility.

## Student Admissions

The teaching reform designedly left an issue unresolved that concerns public opinion and political leaders to the highest degree, namely the specific characteristics expected of a physician practicing at the dawn of the twenty-first century. Dealing with this issue is tantamount to calling the Faculty of Medicine's admission criteria into question.

To be plain, we must take a critical look at candidate-selection criteria and the reliability and validity of the admission process. An exercise of this kind has the long-term goal of identifying the students most likely to rise to the challenges of the medical profession. The short-term goal is to identify students who can come into their own in a system that privileges autonomous learning and, through small-group work, communications. These students must already display relevant human qualities, including scientific curiosity.

At Sherbrooke, about 80% of students admitted to the Faculty of Medicine come directly from *Cégeps*, which have features of community and junior colleges. Only 20% have already a year or more of university education, whereas, in other Quebec medical faculties, the figure is 40% to 60%. The candidates' average age is only 19.5 years, the lowest of Quebec's four medical faculties. For ten years now, those in charge of admissions only considered candidates' prior academic record (which corresponds to the grade point average, or GPA, of American universities). This method of selection has drawn sharp criticism from both within and outside the Faculty. Many people have called for urgent review of admission criteria and procedures.

A commission examined the subject in 1990-91. A first theory put forward would have it that the qualities required of a "good doctor" should already be present and recognizable in candidates; the mandate of the program would then be no more than to allow the students to blossom within a suitable setting. The job of those responsible for admissions would be to administer and, in fact, develop valid, reliable, practical measuring instruments enabling the selection of candidates with suitable qualities.

A second theory would have it that these qualities are less significant than basic intellectual capacities. Research conducted on the predictive value of academic results shows that they are only significant in relation to lecture teaching in the first, preclinical years of the traditional curriculum (Edwards, 1990). Within this frame of reference, the qualities expected of a physician will only be acquired if the teaching system has the proper features for eliciting them. In short, since the setting shapes the individual, it's wiser to invest scarce and costly resources in learning than in selection.

There is probably some truth in both theories. By holding off a reform in admission procedures, the Faculty of Medicine chose to test its new teaching model on a student body similar to that of the old curriculum.

The experience gained since 1987 with six student cohorts (three of which have completed their studies) and original educational methods have enabled us to better see what qualities are needed to navigate studies of this kind successfully and satisfyingly. At the level of graduate education, however, a third year's observation has shown that in both good years and bad, about 20% of students failed to harmonize their personality traits and learning preferences with the Faculty's requirements.

Revision of the admission criteria would take account of those aspects privileged by other programs that have made similar educational choices, pending the ripening of experience at Sherbrooke to the point where more precise observations can be made. Assuming equal academic ability, initial choice should favor candidates with a sense of initiative and hence an ability to function independently and in small groups. A second level of selection would favor those who have demonstrated concern for humanism.

## Student Assessment

The question of student assessment was broached right from the first stages of planning of the reform. We were aware that decisions made would have considerable impact on the way of learning and the degree of learning accomplished. Several years of implementation of the PBL program have yielded highly satisfactory kinds of problems. Assessment of learning continues to constitute a real challenge, however.

## Tutor Assessment

In spring of 1993, the «stewards» voiced afresh students' anxieties about tutor assessment. They contested its highly subjective nature and the fact that some tutors rated everybody as "competent", thus penalizing stronger students. Students doubted the ability of most tutors to use the assessment grid in a valid and reliable way. They decried its being assigned a weight of 20% in a unit's overall assessment, saying that it should be worth only 5% or 10%. These observations are typical of comments we have heard for several years.

The program's administration considers that the reasons for using this method of assessment of PBL units are still valid: non-cognitive areas are difficult to assess using other means, and if something is not assessed, it is often considered trivial. We must nevertheless concede to the students that tutor assessment has its failings and that the corrective measures taken did not yield the hoped-for results. Since many tutors are not very good assessors, there is plenty of room for recriminations and feelings of injustice. The difficulty of standardizing assessment results from one tutor to another remains the most significant irritant. The instrument used still results in little distinction between stronger and weaker students, even though it has been reworked by tutors.

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A study done showed that only two factors influence the discriminatory power of this instrument, namely a unit's duration and whether a tutor's average grade is high (Blouin et al., 1992). The longer a unit, the greater the spread of grades, and the higher the average grade, the greater the potential spread. No other factor examined, be it the assessor's sex, age, expertise, or other, influences the grade spread, i.e., the instrument's discriminatory power.

These results confirm two impressions often voiced by tutors. It is hard to pass certain judgements on the basis of only twenty-five hours spent in tutorial with the same students. As well, it is difficult to distinguish among grades of "competent", "good", "superior", and "excellent". With students behaving in a relatively homogeneous way, it is hard to grant higher grades, while it is easy to differentiate weak showings (although it is touchy to identify them with a grade of "weak"). And last, it is often claimed that autonomy and humanism are almost impossible to assess in the tutorial setting. As shown by a recent study, PBL tutors hesitate to assign a grade of "weak", even when their written comments point to weakness (Cohen et al., 1993).

Teachers find it hard to accept that tutors' grades, which are absorbed into the unit grades, can enable weak students to pass even if they have failed the written summative assessment. What would be preferred is for the dimensions that figure in the tutor grid to be assessed longitudinally through the course of all units (See Chapter 5). If this were the case, though, what would the passing grade be and how would the units be weighted?

The message, then, is loud and clear. Teacher-training activities, upgrading workshops, tutors' weekly meetings, similarity of tutors for a given unit: none of these has worked to win full acceptance for tutor assessment, whether by teachers, students, or even those in charge of the program (some of whom have not hesitated to publicly criticize this instrument's lack of credibility). It is not yet known how far this resistance extends. How many tutors use this mode of assessment inappropriately? How many students feel themselves injured? What we know is that some tutors evince fatalism or a sense of powerlessness by persisting in giving every student in their group the same grade.

These difficulties are also revealing of our socioeducational system's tendency to value only the cognitive. The results of written tests still prevail, to such a point that some people believe a student could fail at the end of a unit with only one or two wrong answers. Class averages are relatively high for PBL-unit written examinations, even though the acceptable performance level has been set quite low, evidence of teacher leniency in examinations. The Evaluation and Promotion committees continue to discuss the issue.

### *The assessment system*

From the outset we wished our assessment system to be consistent with the educational intentions, methods, and goals of the education provided by the MD program. Thus we

specified what was to be assessed, tried to find the best means to measure it, and decided on the kind and timing of assessment, with yearly promotion in view.

In general, the University of Sherbrooke functions by subject promotion, i.e., on the basis of two-, three-, or four-credit educational activities (with one credit corresponding to fifteen hours of teaching during a term). A regulation allowing for an exception regarding assessment governs the faculties of Law and Medicine only, specifically the MD program in the latter faculty; under this exception, promotion is by year of study. Accordingly, every year, the Promotions Committee judges student results using a system of grades according to which a passing grade is 1.8 out of a maximum of 4.0 for preclinical training and 2.0 out of 4.0 for clinical education. Internal rules stipulate that a student shall not be promoted if he or she fails any PBL unit. In these cases, students resit the unit's exam. Overall, these regulations have served us well. Some weak students have been dropped from the program; others have had to redo a year (once, eight students had to redo second year); still others have merely had to resit some unit exams. And, in some cases, a recommendation has been made for a student to see a student advisor or do specific clinical rotations. The new system seems to work well, but, in practice, it is as though promotion were still being done by subject.

Under the old curriculum, students had to sit an exam every three or four weeks. To reduce stress and enhance the potential for integration of various subject matters, the new program provides for written summative assessments no more than three or four times a year. The desired integration of subject matters and that of preceding units has not, however, occurred. Since failure in a unit's written summative assessment is hard to accept, in practice we are dealing with a system similar to that of the old curriculum: one written examination per unit subject matter. Nevertheless, at least questions no longer involve the memorization of isolated facts, and examinations are held in clusters every three months.

The debate persists between defenders of assessment methods specific to the objects of learning and advocates of a more open educational philosophy that allows students to learn and make mistakes without being concerned to measure progress at every stage. Advocates of the second approach propose holding only one yearly summative examination that would cover all the subject matters. These two approaches are in direct opposition: one group argues that we must fulfill our mandate to monitor learning regularly and identify at-risk candidates early; the other reasons that we must show confidence in students' ability to learn and reduce our need to proliferate methods of verification.

Debates on these issues aside, the implementation of the reform and its system for assessing learning has led to the partial attainment of the major goal: to transform learning to allow for the cognitive activities of reasoning and analysis. The PBL method allows for this, as confirmed by preliminary results from our research (Patel et al., unpublished). We wanted to provide assessment consistent with the analytical process elicited by the new learning

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method. Recourse to open-ended questions, problem-analysis questions, structured oral examinations, and even tutor assessment would seem to fit the bill, at least partially.

More recent cohorts of students, however, seem to be less enthusiastic and less willing to push back the frontiers of their knowledge than were those in the first two. This trend is of considerable concern, since it seems to be fostered by our assessment system. Our modes of action with weaker students are of questionable effectiveness. There is even some doubt as to the appropriateness of using them, on account of the way they impact on motivation and their debatable legal equity: should we impose a rigid assessment system on the majority of students who are "at least competent", when it may have undesirable effects on the direction of their learning? True social equity would have us choose the system that has the least penalizing effect on both the student learning and the University seeking to grant diplomas of quality.

## Conclusion

We have tested the new program's theoretical construct against our original intentions. As we learned progressively throughout the course of our evaluation, the new contents excite students less; their curiosity is dulled and they no longer show a desire to acquire ever more knowledge. We would have liked to see the effect of novelty persist for longer. We let ourselves be influenced by students who lack enthusiasm, forgetful that three-quarters of our students find our studies stimulating. And yet, to judge by certain observations we have made, at the graduate level, working in a context closer to that of their own future clinical practice, students rediscover the motivation to learn. What remains to be seen is whether this renewal of enthusiasm rests on the principles advanced during their undergraduate education.

Our basic anxieties as educators remain. Is the program now capable of doing more to educate the "good doctor", in cognitive and psychomotor as well as affective terms? Does it enable students to integrate all their knowledge into a cognitive schema that favors the learning and maintenance of clinical reasoning? Does our program produce the desired effects or is it no more than an educational game in which the problems lead to learning objectives that have been passed down by more senior students? Some ask whether we have created a system in which students can get away with learning just enough of the subject matter to correctly answer questions out of a bank recycled by consulting earlier cohorts. Is this a caricature of the truth? Possibly. But many professors who are worried about the situation blame it on the present system of assessing learning. Yet it was our belief that the range of measuring instruments we developed and implemented for assessment satisfied our requirements.

Our next priority is to revise our assessment system. The new socioeducational culture now allows us to contemplate developments that would have been implausible in 1986. Our milieu has undergone collective enrichment. Cognitive education and the resources available from the Center for Medical Education will be valuable assets. Nevertheless, no tool will ever replace professors' judgement. Society will always expect them to determine whether graduates in medicine have the competencies they need and can perform the way MDs are expected to.

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## Epilogue: Letter to Charles

by Jacques E. Des Marchais

Dear Charles,<sup>1</sup>

Congratulations to you and other members of your faculty on your courageous decision to launch a teaching reform! You will be the first faculty in your country to adopt modern medical education methods. I can well understand your desire to be involved as a leader, because I am aware of your interest in innovations in teaching and learning. If you choose to accept the mandate, I can tell you from first-hand experience that you will embark on one of most exciting phases of your professional career.

You know as well as I do that MD programs no longer satisfy either the requirements of modern teaching and learning nor the needs of a society undergoing rapid change. Hippocrates guided his students along winding roads to knowledge. The findings of cognitive psychology show that students can no longer build knowledge structures using traditional methods and then apply them to the solution of complex clinical problems. They must have access to programs of a different kind in order to become autonomous learners, show concern for the costs of health care, and participate fully in the evolution of health policy and the distribution of care in their countries.

You are wondering about your ability to bring a reform of teaching and learning to completion. Such an adventure, because that is what it is, entails a whole range of requirements, limits, and frustrations. Nevertheless, it will give you access to a wonderful world of personal accomplishments. As I consider the experiences I have been through over the past eight years at University of Sherbrooke and those that colleagues around the world have told me about, I would like to share with you certain reflections that I consider fundamental to the success of such an undertaking. I have grouped them around four specific themes in the following three sections: preparation of the reform, implementation of change, and institutionalization of the reform.

### Laying the Groundwork for the Reform

#### *Take the time to get well prepared*

For a physician who is competent in his or her specialty, clinical problems no longer present difficulties. The same should hold true for you in educational reform. Mastering

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<sup>1</sup> Charles is a physician, clinical researcher in neurophysiology, and medical educator, who has not received specific educational training. He has just been requested to take on responsibility for the reform of teaching and learning in his medical faculty's MD program.

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the principles of medical education and the stages of systemic curriculum planning will enable you to compel acknowledgement of your competence and establish your credibility. The processes of change can be conducted intuitively, but the theories of change and its different stages are known. This knowledge will allow you to identify and analyze problematic situations in the heat of action. What leadership model will you choose? A university is not an army! Orders are not very effective. Universities have a phenomenal capacity to develop resistance mechanisms. How can you get around these difficulties? Well, leadership skills can be learned.

### *Get a clear mandate*

A broad reform must be accepted and backed by a large proportion of those involved in it, in this instance professors and students. The dean must support it constantly and unequivocally as a priority for faculty administrators. All the activities presuppose an injection of funds. Decisions made by the faculty's administrators will show to what extent the project is valued. These will serve as unequivocal indicators of intentions. This initial support must come through again and again all through the unfolding of the reform. You may find you are obliged to settle for political compromises, but never on fundamental principles, on the basic reason for the existence of the reform initiative.

If, as in your case, the dean is not the project manager, you will also need the backing of all those people who provide social legitimacy: the heads of the major departments, the key individuals, people that everyone has confidence in.

### *Form a core of coworkers: "The team is the leader"*

A fully successful reform would be accepted by every single professor and defended by them. That is the ideal, but it is impossible! As well, no leader should act as a lone ranger. He or she must win participation at the outset by a small core of individuals, which will broaden and then multiply. This constitutes an extremely productive strategy. The sooner these coworkers become competent, the greater the chances of success. Team spirit is produced, grows, and becomes productive. Those whose behavior is less directive benefit from the creativity and intelligence of their colleagues. Knowing how to lead a team thus becomes a new competency to acquire.

Even if you believe in the power of team spirit, it will take a lot of energy to develop it. Your colleagues will need to be actively listened to and know that concern exists not just for their academic productivity but also their personal growth. Building up team spirit requires skills in interpersonal relations, and for this you need to have time, and to be receptive, attentive, and above all understanding.

In the Faculty of Medicine at University of Sherbrooke, we invested a great deal in creating team spirit, by cultivating a feeling of festivity. On numerous occasions, we organized special meetings around a table and acknowledged each person's individual contribution

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with little symbolic gifts. The time assigned to these "little things" yields dividends. Besides, there's something in it for you: giving becomes personally validating.

*Develop a well-structured description of the orientations of your reform*

The orientations, goals, and objectives of change must be well-known, widely disseminated, and communicated to the largest possible number of people if you want your community to take ownership of it. The leader must act according to fully transparent orientations and credible strategies. The need to prepare a fundamental document, a discussion paper, soon becomes self-evident.

In the fall of 1986, I and my colleague Bertrand Dumais were conducting a tour of departments with our document presenting a framework of the new curriculum. On numerous occasions, the dean, Gilles Pigeon, stressed that we should put our proposed reform in writing, producing an overview document that would state its orientations and components, how it would be evaluated, and what it would cost. It took me a while to understand the reason for his insistence on this. I should have agreed to the process sooner; it would have spared me giving over my Christmas holidays to it!

This exercise is an essential one for the leader to conduct. The overview document becomes extremely useful for informing others and staying focused on the goals of change. Later on, when the time comes to evaluate your experience, it enables you to come back to what intentions were at the outset. Writing it forces you to clarify your ideas and determine on the procedure to follow. Publishing a discussion paper entails a fundamental attitude that allows for acceptance of compromise and the validation of one's project by one's closest collaborators.

## Implementing the Reform

*Display professionalism*

An initiative for change of this kind requires the full commitment of the leader, and this is where one discerns the features of true professionalism. We had to serve as role models for our colleagues. After all, setting an example confers moral authority and serves as your most powerful tool. Before people accept the change, they will have to believe in you, your judgement, your ability to understand complicated situations, your skill in rallying your colleagues, and above all, your long-term vision of your project. During this stage you must display patience, tolerance, understanding, attentiveness, and the ability to listen. You must be decisive, persistence, and firm, and have unshakable faith in your mission.

The need to reach your goal brings with it other requirements. You can compromise on secondary matters, but never the basic principles of your discussion paper. You may sometimes find you're the only one defending the path to be taken. You may be surprised that your most faithful supporters and coworkers have briefly left you in the lurch.

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Sometimes you will have to make a personal sacrifice. Your willingness to pay this price will elicit the confidence of others in the project for which you are the standard-bearer. Your colleagues will then agree to take risks to further the project that you have put forward.

### *Build a network of advisors*

I believe a leader's authority rests on a tripod whose balance must be constantly maintained. Knowledge of the subject (teaching/learning, reforms, change) is the first leg of the tripod. The second is skill in keeping a team together, and the third, that of putting together a network of advisors. It is always valuable to be able to benefit from the experience of experts in the field (in a way that goes beyond reading their publications). When the time comes when your interpretation of their work is challenged, or others hope to get you to deviate from your basic principles, your advisors will provide invaluable support.

Our advisors were brought on-board right from the first stages of the change. Access to the group that constitutes the Network of Community Oriented Educational Institutions for Health Sciences enabled us to get to know colleagues who shared our concerns. We maintained very special ties with our advisors. As with your coworkers, you will need to invest time and energy in strengthening your relations with your expert advisors. In a sense, they will become "friends of the Faculty".

### *Do work that has an academic bearing*

The breadth of the educational reform will require much effort, energy, and time, on the part of many members of faculty. Your colleagues will be all the more inclined to contribute if they stand to benefit academically, for instance, by generating publications and papers. Your emphasis on conducting the reform and related projects as a form of scientific research will create a climate of respect, in particular among basic researchers. Conflicts of opinion soon turn into research hypotheses and projects; in our case, some of these were even funded.

Many members of our faculty who did not conduct basic or clinical research found that education and the reform of the program served as fertile soil for scholarly production. Now, this will only take place if the University's system of promotions makes it easy to recognize such work, which was the case for us. Little by little, medical education is thus acquiring a pedigree.

### *See that an information network is in place*

Your information network should serve two purposes: transmitting information and receiving it. Nothing is more effective than the provision of information to help a person better understand a subject and realize that a proposed change is not so threatening as they thought. It's a challenging mission to bring teachers, students, and administrators to agree on a single interpretation of the benefits of reform.

Two types of activities were used to transmit information at the Faculty of Medicine at University of Sherbrooke. First, external formative evaluations of the program, twenty or so workshops for visitors, and annual evaluation days provided our advisors with the opportunity to observe program implementation and to offer a critique of its alignment with the initial project. The second activity consisted of preparing a document on the reform of the MD program, which proved a surprisingly welcome opportunity to better define, specify, and articulate the various components of the reform, and then analyze and critique its implementation. Preparing the chapters, proofreading them, and checking them allowed us to reach agreement on our understanding of these components.

The second purpose of your information network, receiving information, occurs parallel to the first. It consists of knowing how to listen, understand, and not seek to defend yourself, in order to better identify difficulties related to implementation. I myself found that this attitude is hard for a leader involved in the action to acquire. On many occasions, my colleague Bertrand Dumais and I came up against resistance from the "prima donnas". Never did we settle for a confrontational climate. On the contrary, knowing how to listen, respond with explanations that situate the project in relation to experiences that have occurred elsewhere, and acknowledge the limitations of this knowledge and one's own limitations, proved to be highly profitable.

But be aware that it will be easier for you to make use of this set of attitudes at the beginning than over the long haul. As the action unfolds, you will reach your threshold of intolerance.

## Institutionalizing the Reform

### *Turn the reform into a faculty of medicine project*

Any society will contribute more to change when the benefits to the group are clearly evident. This holds true for a nation, a family, and even a faculty of medicine. Everyone should be invited to get involved in the reform initiative: professors, administrators, students, graduates, all have something special to offer. Your strategy should ensure that the implementation process is viewed as a Faculty-wide project.

In the course of our own experience, visitor workshops, outside presentations, publications, press releases to university and medical newspapers, the open house for future students, annual assessments, large-group meetings of all involved in the project, research projects, the development of the Centre de pédagogie médicale, and accreditation visits, all served to convey the same message: the educational reform concerned the whole Faculty.

### *Obtain student support*

Our Faculty of Medicine owes much to the students of the new program's first cohort. They served as our best advocates to teachers. When problem-based learning, which served as

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the vehicle for educational reform in the Faculty of Medicine, was being put in place. students from the first cohort cooperated fully in introducing teachers to the approach. We constantly asked for their comments and reactions. They were called on to fill in numerous evaluation questionnaires. Again and again, we told them that they were our most important helpers in improving the system! We meant it, and they knew it. "Teachers are asking for our comments", they said to themselves: "they listen to our opinions, they take notes, but we find that they act on them too late".

We continue to consider our students to be our partners of choice in improving the system. They are always invited to evaluation days, monthly meetings of PBL stewards, and above all, visitor workshops. On all these occasions, they show how PBL works, help the visitors to build problems, and comment on their assessment of the program.

The unsolicited loyalty of the students eventually brought about that of the teachers. Students' support, their enthusiasm, their pride in their program, their interest in improving it, all served as "training wheels" that ensured the system did not quickly revert to sclerotic "diseases of the curriculum".

#### *Let others go beyond you*

Charles, this strategy is one of the hardest to apply. You will see your authority and influence gradually increase as the reform succeeds. It will be hard for you to dissociate yourself from this process. It is tempting to hang on to a management role. While it may be true that successful reforms are associated with a leader's incumbency in the same position for at least a decade, you must still start thinking very early on about preparing your successors. It is not always easy to strike just the right balance between responsibility and power sharing on one hand, and the maintenance of firm and consistent leadership on the other.

Success in implementing the reform will result in numerous spin-offs, and these too you should share with your coworkers. Don't lose sight of the ultimate goal: the reform must become a Faculty-wide undertaking that will continue to improve and develop after you have turned the helm over to a carefully chosen, trained, responsible team. There is no infallible recipe for choosing the right people. You can only use care and exercise your best judgement

As you grow old along with your program, it may bring you great pleasure to see your colleagues acquire competence and experience. Your objective then becomes to let them "climb on your shoulders" so that they can go farther than you.

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## Prevent Sclerosis

You will have one last responsibility before handing off the baton. Institutionalization is necessary so that the work done can be continued. This will ensure it a certain degree of permanence. Institutionalization, of course, means introducing the risk of «diseases of the curriculum.» No matter what you do to prevent it, the day will come when innovation turns into tradition. That is the fate of all innovation and all institutions. But you will want to slow this process down by introducing factors to sustain the process of change, such as reviews and internal evaluations. The MD program will always have to readjust to meet the new needs emerging from a society in constant transformation.

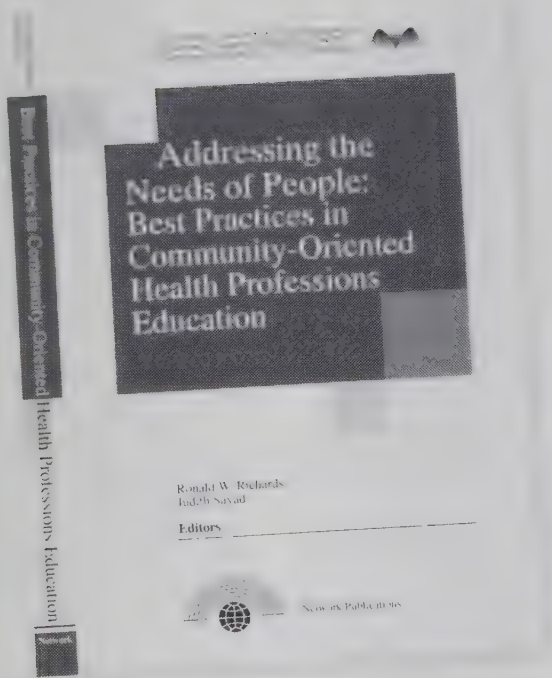
## Conclusion

Dear Charles, I hope that you will not consider this set of suggestions as a life plan. If you remain at the helm of your reform for eight or ten years, both the system and your colleagues will provide a great deal of support at each stage. I know how much you wish to succeed, and I also know that you have all the qualities to steer the reform to safe harbor. Nevertheless, let me share with you one last reflection that was conveyed to me one day by one of my best coworkers.

*"Don't forget that every change is equally an affective and a cognitive process. Yes, the order in which I presented those adjectives is intentional. Even though you have worked furiously to get us to understand the 'excellent reasons' for the change, namely that new knowledge emerging from new needs called for a new system, my first experience of the reform was a highly affective phenomenon. I needed first of all to believe in the venture, and to believe in those who put it forward. It's for this reason that I am advising you to continue to elicit highly active participation from the largest possible number of our best colleagues. It is thus and only thus that people come to understand things properly, to internalize them, to subscribe to them, and then to have the desire to share them."*

Dear Charles, I wish you good luck.

Jacques E. Des Marchais



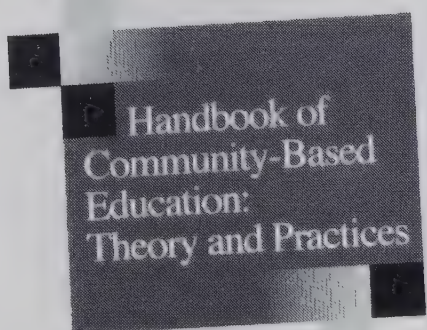
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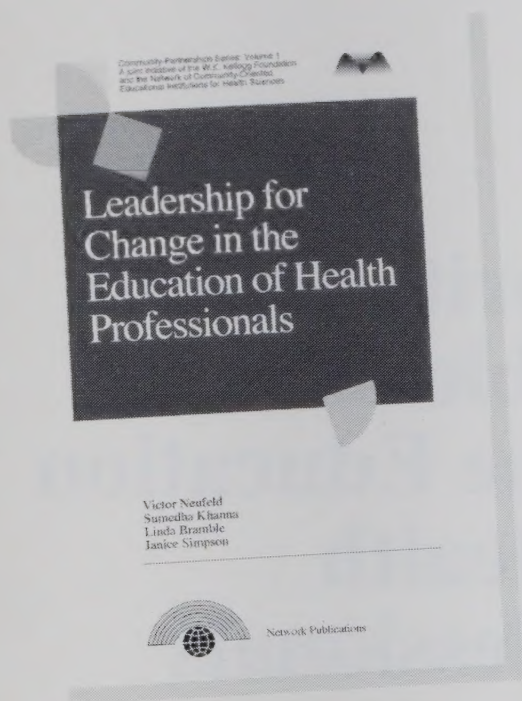
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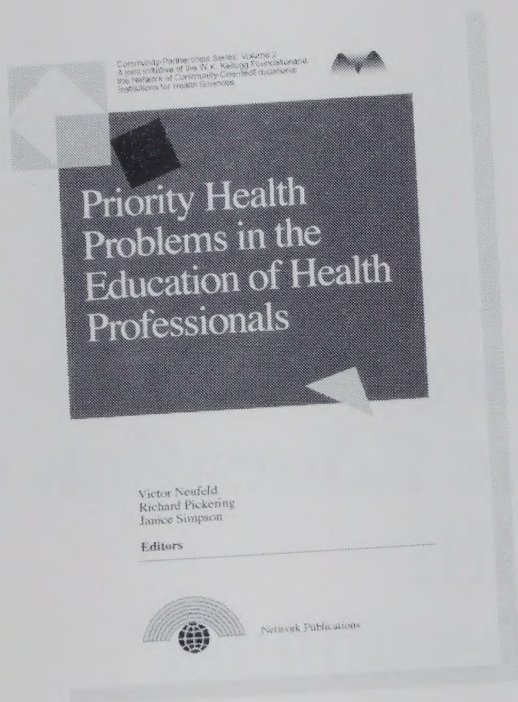
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*L*earning to Become a Physician summarizes the total shift in how medicine is taught at the *Université de Sherbrooke* in Quebec, Canada. The Sherbrooke experience presents a case history of evolution in medical education at the start of the 21<sup>st</sup> century.

Although initially intended for professors and teachers in Medical Faculties, this book offers valuable information and insight to fundamental and clinical researchers, teachers, lecturers, administrators, and anyone else looking to initiate change in how future physicians are trained. The reader, led chapter by chapter through the Sherbrooke experience, is called on to take an in-depth look at the ways in which medical education can better respond to community needs.

From a more general perspective, this history of institutional change at Sherbrooke will be of interest to anyone teaching at the university level because it analyzes a reform program gradually implemented over a ten-year period that adopted problem-based learning as the vehicle for centering the educational system on the student.

Jacques E. Des Marchais earned a master's degree in education in 1974 from Michigan State University (United States). As orthopedic surgeon by training, he has been involved in medical education for more than a quarter century, while remaining an active clinician.

The Founder and President for a decade of the *Club de pédagogie médicale du Québec* (medical education club of Quebec), Des Marchais set up the *Unité de recherche et de développement en éducation médicale* (unit for research and development in medical education) at the *Université de Montréal*. Moreover, he developed a basic training program for his teaching colleagues.

During this period, he was appointed Professor of Surgery.

From 1985 to 1996, Des Marchais served as Academic Vice Dean in Sherbrooke's Faculty of Medicine where, as the Head of a core of innovators, he led the curriculum reform that implemented a major shift in the medical program.

Des Marchais earned international recognition as the Chair of the Executive Committee of The Network: Community Partnerships for Health through Innovative Education, Service, and Research. On the national scene, he is known for his involvement in the Medical Council of Canada and the Royal College of Physicians and Surgeons of Canada, as the Vice-President for Education.

